PROCEEDINGS

OF THE

FORTIETH

# INDIAN SCIENCE CONGRESS

LUCKNOW, 1953

PART -- III

# ABSTRACTS

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# PROCEEDINGS OF THE FORTIETH INDIAN SCIENCE CONGRESS

## PART III—ABSTRACTS

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# *40th INDIAN SCIENCE CONGRESS, LUCKNOW, 1953*

## SECTION OF GEOLOGY AND GEOGRAPHY

*President*:—Prof. N. L. SHARMA, M.Sc.

## MINERALOGY & PETROLOGY.

### 1. Study of an occurrence of Albite-Epidote Rock from near Shusina (Manbhum, Bihar).

SUDHANSU ADITYA, Calcutta.

These rocks, composed almost entirely of albite, epidote, allanite and piedmontite, were reported by Dey as "Albitite" from near Shusina (22°57′ : 86°37′). Their resemblance with the epidote-bearing helsinkites has been reviewed, but in view of the confusing nomenclature of such rocks, these rocks are termed simply "albite-epidote rocks".

The outcrop is lens-shaped, running N.W.-S.E., parallel to the strike of the country rocks, for half a mile.. It occurs in schist and phyllite, about 3 miles south of the granite outcrop. Riebeckite has been formed in the epidiorites adjacent to this body due to action of Na-rich solutions.

Peculiarities in their chemical composition are the presence of appreciable amount of MnO, rather high Fe-oxide and a low CaO. Alkali content, chiefly the $Na_2O$, is high. Its $K_2O$ content may be due to the presence of orthoclase. Evidences available from the variation in their mineralogical, textural and chemical compositions, the alteration in the adjacent rocks, the nature of feldspars and the presence of replacement features suggest that these rocks are formed by replacement of pre-existing rocks by the metasomatising soda-bearing liquids originating from the granite.

### 2. Stilpnomelane—a product of low-grade metamorphism.

A. K. BANERJI, Calcutta.

Occurrence of stilpnomelane in epidiorites from the Chlorite Zone of metamorphism in Argyllshire, S. W. Scotland, is reported. The optical properties of this mineral are—

Colour—generally brown but occasionally green.

· Strongly pleochroic with X = Yellow brown, Y = Z Dark brown or greenish brown.

$$\left.\begin{array}{l}\alpha=1.605\\ \gamma=\beta=1.645\end{array}\right\}\ \text{Birefringence } (\gamma-\beta)=0.040$$

$(-)2V = 0^\circ\pm$

Chemically it has a high FeO/MgO ratio and appears to be rich in $K_2O$. A quartz-chlorite-stilpnomelane-albite-hastingsite-calcite-schist containing a high proportion of this mineral has been analysed and its C.I. : P.W. Norm and Modal analyses are also given. This rock is more basic in chemical composition than an average basalt. It has been suggested that the unusual basic character of this rock and the corresponding mineral assemblage is due to ferromagnesian metasomatism in the presence of water and $CO_2$. in the pore solutions during the low-grade metamorphism of a pre-existing basaltic rock.

### 3. Petrology of the Lamprophyres and Associated Rocks of the Raniganj Coalfield.

S. BANERJEE, Calcutta.

Differentiated dykes and sills of Lamprophyres giving following variations—'biotite-peridotite' passing into 'biotite-lamprophyres', 'minette' and 'kersantite' to types with olivine; with olivine, pyroxene (pigeonitic diopside and acmite) and soda-amphibole; with olivine, and leucite; with olivine, leucite, pyroxene and soda-amphibole; and of feldspar free 'biotite-olivine leucitite', have been studied from the Raniganj coalfield. 'Biotite-lamprophyre with olivine, grades often at dyke margins into 'micro-syenite'; and stringers from dykes are often 'quartz-carbonate rock' or minette or kersantite without olivine. One such stringer is composed of two antipathetic minerals, olivine and alkalifeldspar.

Feldspars wih profuse apatite occur in the groundmass as undeterminable microlites and spherulites. Discrete grains of orthoclase also accompany them. Secondary quartz and calcite are often present. Biotite (phlogopitic) is as usual, euhedral and extraordinarily fresh; it is often phenocrystic and is occasionally enclosed within stringers of extremely altered feldspars penetrating sandstone. Pyroxenes and amphibole are confined mainly to the border of intrusives and have probably been formed as a result of assimilation from the contact sandstone.

The texture of the rocks varies from coarse allotriomorphic particularly in micro-syenite and peridotite, to nearly panediomorphic to fluxional in minette and kersantite. Parallel arrangement of biotite and tangential alignment of it around circular 'ocelli' of olivine or its secondary products have frequently produced special textures. The fluxional texture and penetration into sandstones in stringers indicate consolidation of the rock-suite from magma. Differentiation is believed to be primarily magmatic. Crystallisation of biotite earlier than feldspars and in thin stringers of feldspar in sandstone rules out its possible later hydrothermal introduction.

### 4. A note on "Zoned Tourmaline" from Rajgarh area, Ajmer-Merwara.

S. K. BOSE, Udaipur.

Tourmaline is one of the aboundant minerals in this area found in many pegmatites and schists. It occurs as nematoblastic, xenoblastic, idioblastic and poikiloblastic crystals, often replacing portions of the schists and quartzofelspathic material. Tourmaline is of schorl variety and usually shows zoning. In one case, 12 different zones have been observed. A detailed study has been made about the form and nature of colour zoning in tourmaline and it is suggested that the growth of tourmaline has taken place in solid medium due to metasomatic replacement and the colour zoning is probably due to the rate of diffusion of copper, iron, etc. and their oxidation.

### 5. The Petrology of the Basic Intrusives occurring near Panchvati Ghat (Jabalpur, M.P.).

V. N. CHHIBBER, Banaras.

A petrological investigation of the basic rocks intrusive into the marble, near Panchvati Ghat, Bheraghat and the Dhuan Dhar Falls reveals that it is this igenous activity which has been responsible for the development of talc of the neighbourhood of Bheraghat. The basic rock-types, and the contact effects of the basic intrusions on the marble which forms the country rock, are described in the paper. The thicknesses of the dykes vary from a few inches to several feet. Various types are represented in these basic intrusions which are: 1. Quartz-hypersthene-biotite-gabbro. 2. Olivine-gabbro. 3. Epidiorite, and 4. Dolerite. They are chemically analysed, their molecular proportions and norm discussed and variation diagrams studied. Xenoliths of marble in the basic dykes have been studied.

Whenever large basic dykes are intrusive into the country-rock, viz., the marble, the latter has been coarsely crystallised. The interchange of material is denoted by the formation of the tremolite-rock and also the steatite developed in several places. The steatite deposits of this region so formed, are of great economic value, and the mining of steatite in this region, constitutes an important industry. Other contact facies include the tremolite-schist, talc-tremolite-schist, anthophyllite-schist and the anthophyllite-talc-schist.

Below the Panchvati Ghat near Bheraghat, a yellowish white siliceous rock occurs forming a dyke-like intrusion. Similar injections are observed at other places in the neighbourhood of Bheraghat. Sometimes xenoliths of the marble are enclosed in these siliceous rocks, and at the contact it is coarsely crystallised. Apart from the siliceous dyke, the marble rocks as seen near the Dhuan Dhar Falls are injected by quartz veins and these particularly on weathering reveal a highly puckered nature of these injections.

### 6. A note on the Granitic Rocks occurring in the neighbourhood of Jhansi, Orchha and Datia (Bundelkhand).

V. N. CHHIBBER, Banaras.

The formation occupying the areas consists of massive granitic rocks indistinctly foliated and traversed by gigantic quartz reefs and by numerous basic dykes. The granite sometimes forms hills, but the general features of the ground are gently-undulating, sparsely-cultivated uplands, with shallow valleys, traversed at intervals by quartz veins in the form of abrupt wall-like ridges.

The typical rock is a coarse biotite-granite, and the term "gneiss", as conveying an idea of foliation is not applicable since there is very little difference between it and a normal granite. The other rock-types include biotite-hornblende granite, hornblende-granite, hornblende chlorite-granite, and the chlorite-granite.

A study of the pegmatite veins, quartz veins, and the basic dykes of the area has also been undertaken. Of the basic rocks the types include a basaltic rock, bearing pyrite and at times chlorite also, pyritiferous anamesite, and dolerite, bearing pyrite and chlorite.

### 7. Hydrothermal alteration of the Peridotite Intrusions of Manpur (Dhalbhum, Singhbhum).

S. C. CHATTERJI, Patna.

The peridotite intrusions cut through the older dioritic and granitic gneisses. They have been altered to talc-carbonate rocks and asbestos. The olivine has altered to mesh-structure serpentine, the pyroxene has been also serpentinised and the lime liberated has metasomatically replaced the chrysotile and converted it to tremolite so that the bulk of the deposit is tremolite. Possible chemical reactions are suggested and microscopic evidence adduced.

### 8. Zonal Metamorphism in the Balasan Valley, Darjeeling Himalaya.

ANIRUDDHA DE, Calcutta.

The area between Darjeeling Himalayan Railway line and the Nepal-India Frontier in the Kurseong subdivision, Darjeeling District, West Bengal, has been geologically mapped and mineral isograds are delineated by the observation of the first appearance of the index minerals of Barrow. All the normal zones of chlorite, biotite, garnet, kyanite (together with staurolite) and sillimanite have been mapped with the help of the metamorphic equivalents (schists and gneisses) of the argillites, the calcareous sediments and the basic rocks—epidiorite and green beds.

Two petrological features in the area need special attention—(a) The grade of metamorphism increases upwards, i.e., the highly metamorphosed rocks overlie those of lower grades in perfectly uninterrupted inverted sequence. (b) The highest grade rocks exposed in the higher levels of the hills (above 4,000 ft. or so) are intimately permeated and injected by the granitic materials, forming various types of gneisses.

A detailed study of the features viz., snow-ball garnet, micro-folds, etc., show the synchronous time relation between metamorphism, granitization and deformation. The metamorphism is paratectonic and the regional rise of geoisotherms are modified by igneous impregnations of granitizing materials.

### 9. Petrology and Metamorphic Facies of Basic Rocks from the Balasan Valley, Darjeeling Himalaya.

ANIRUDDHA DE, Calcutta.

The metamorphic basic rocks of the area are the epidiorites occurring as sill-like lenticular bodies, and the green beds, which may be sedimentary rocks (or contaminated basic igneous rocks). The biotite zone assemblages (a) hornblende-epidote-acid oligoclase-ilmenite-quartz with or without biotite (epidiorite) and (b) hornblende-oligoclase-biotite-chlorite-ilmenite-quartz (green bed) are referable to the biotite-chlorite subfacies of the green schist facies. The above (a) is equilibrium assemblage and its metamorphic grade is undoubtedly evidenced by the associated biotite schists which are also in the biotite zone of metamorphism. This suggests that the stability field of the association epidote-acid oligoclase extends into the high grade part of the greenschist facies, though the lower limit was shown by Ramberg (1944) to be the epidote amphibolite facies. This is corroborated by numerous similar occurrences in other countries. The garnet zone assemblages are (a) Hornblende-epidote-biotite-chlorite-sphene-chalcopyrite-ilmenite-quartz (green bed). (b) Hornblende-plagioclase-garnet-sphene-rutile-ilmenite-quartz (epidiorite). Assemblage (a) is to be referred to the epidote-amphibolite facies, but the presence of chalcopyrite indicates copper metasomatism, so it is not strictly referable to any facies. The assemblage (b) must be referred to the amphibolite facies; this may either represent a lowest grade subfacies within the amphibolite facies, below the staurolite-kyanite subfacies, or it has just reached the staurolite-kyanite subfacies, since staurolite has not appeared in the associated pelites.

### 10. An occurrence of a Sandstone Dyke in New Jinagora Colliery, Jharia Coalfield.

SUBRATA GHOSE, Dhanbad.

A sandstone dyke, quite an uncommon feature in Indian Coalfields, has been observed underground dipping at 75° towards S 21°E and can be traced for about 150 yards along the strike in the New Jinagora Colliery, Tisra area, the easternmost part of the Jharia Coalfield. The dyke occurs in a coalseam, locally called VIII seam, but is actually a split-up portion of V A seam of Fox. The dip of the seam is 10° towards West. The dyke is about 20 inches wide at its base on the floor of the seam, and pinches off near the roof of the seam, which is only 6 ft. thick. About the mechanism of intrusion, it has been suggested that due to some local earth tremors, the wet sandy material was mobilised and pushed up from below into a pre-existing fissure in the coalseam and it consolidated there as a dyke.

### 11. A Basic Igneous Suite from Daltonganj area (Palamau, Bihar).

SURAJIT KUMAR GUHA, Calcutta.

The series of basic igneous rocks occurring in the Palamau district of Bihar, around the town of Daltonganj, has been studied by the author in details. It has been tentatively termed as 'dolerite series', covering a variety of rock types, viz., norites, gabbros, dolerites, epidiorites and amphibolites. These rocks are all shown to be connected to a single petrogenetic history traceable from the original magmatic facies to the high grade metamorphic facies; a thermal metamorphism has been effected by the granites. The typical rocks occur as xenolithic masses, in the surrounding Chhotanagpur Granites.

An extinction angle of 7° to 8° has been noted in hypersthene, common in the rocks, and the phenomenon of 'hypersthenisation' of clinopyroxene is also noted. An unusual occurrence of mica-dolerite has been recorded, mica being formed at the expense of pyroxene by alkali-introduction from the granites.

It is suggested that this suite may represent a new petrographic province in north Bihar, originally proposed by Prof. S. Ray, pre-Granite in age and equivalent to the Dalma volanics. The latter has been subjected to intense metamorphism in the thrust zone and the former has remained undisturbed to this day in the north of the zone.

### 12. A mineralogenetic study of contact-rocks of Daltonganj area (Palamau, Bihar).

SURAJIT KUMAR GUHA, Calcutta.

The interesting group of contact-rocks found near about the town of Daltonganj, consists of rocks varying between pure recrystallised marble or crystalline dolomitic limestone and pure calc-magnesian silicate-rocks. They occur as roof-pendants in the younger Chhotanagpur granite-gneiss; the general trend is E-W to ESE-WNW in common with other associated rocks. They have resulted from the thermal metamorphism of impure dolomitic sediments, caused by the formation of granites.

In the rocks, calcite, dolomite, forsterite, tremolite, diopside, chondrodite-norbergite, phlogopite, spinel, serpentine-chlorite, grossular, graphite, magnetite and talc have been identified. A pneumatolytic assemblage like, edenite-phlogopite-marble and, a metamorphosed agrillaceous band of compositional variation in the original dolomitic sediments—represented by diopside-amphibole-almandine-granulite—were also seen.

A mineralogenetic study has been made following modern lines of arguments of Bowen and Tilley and a field-study of Goldschmidt's mineralogical phase rule has been made. Talc, tremolite, forsterite and diopside are seen to form in order of progressive increase of temperature at constant pressure—the processes being governed by univariant reactions—along with progressive decarbonation. Other reactions involving decarbonation and pneumatolysis have also been confirmed.

### 13. Minerals of Humite group from Daltonganj area, (Palamau, Bihar).

SURAJIT KUMAR GUHA, Calcutta.

Humite minerals, viz. chondrodite and norbergite, have been recorded from contact-limestones and calc-silicate rocks in the area around Daltonganj (Palamau, Bihar). The mineral paragenesis is calcite, dolomite, forsterite, spinel, grossular, serpentine, magnetite, graphite and phlogopite and rarely diopside and tremolite. This agrees closely with those of Parainen (Finland) and Franklin (N.J., U.S.A.).

Norbergite has been recorded here for the first time from India. It has a (+)2V of 47.5°. The chondrodite is of B type of the Mansjo Mt. (Sweden) and the genesis confirms the opinion of Read and Double regarding the origin of Glenleg chondrodites, namely, by accession and replacement in forsterite of fluorine and hydroxyl-bearing molecules from granites of younger age.

Dolomite has been identified and distinguished from calcite, by its limpidity, relative idoblasticity, twinning parallel to the face (0221) and finally by Ceyauxe's micro-chemical method of silver-chromate-staining. Even relative modal distribution of calcite and dolomite was determined by the last method and they were found to be nearly equal.

### 14. Petrochemical interpretation of a Rheomorphic Vein from Angul, Orissa.

PRITHWISH KAR, Calcutta.

A system of thin (fraction of a mm. to 1 cm. thick), highly anastomosing, dense black aphanatic veins has been observed intrusive into a suite of high-grade Archaean metamorphics around the town of Angul in Orissa. The metamorphics include khondalites, pyroxenic gneisses and granulites, granodiorite gneisses and pegmatites. The vein is discordant to the lineation of the host (comprising all the members of the suite except khondalites and pegmatites) and presents sharp, well-defined contacts.

Microscopically, it comprises felts of microlites of andesine ($Ab_{61}An_{39}$) and biotite, with occasional chlorite, rare sericite and few disseminated iron ores, interspaced with patches of glass and few embedded phenocrysts. Xenocrysts of plagioclase and quartz (the latter more frequent with more quartzose hosts) are quite abundant. The groundmass as a whole is non-pleochroic, yellowish brown, with birefringence $= 0.007$. Instances of the vein material transgressing the boundaries of host crystals are common.

The specific gravity is 2.9. Chemical analysis indicates the vein to be undersaturated with 2.62% leucite, 8.54% forsterite and 0.20% fayalite in the norm. Niggli Values of the vein compared with those of the other rocks of the area in a ternary diagram imply that the khondalites approach closest to the vein, the position of the latter being in the Sedimentary Field of Trinagle III of Niggli's Tetrahedron. The vein is regarded to have been derived through the fusion of a sedimentary material approaching the khondalites and subsequent intrusion into the country, or, in other words, 'rheomorphic'. The heat might have been provided by the granodiorite gneisses, the liquid retaining sufficient fluidity even after the bulk solidification of the former. Crystallisation was arrested at an early stage due to the small bulk of liquid, the chilled portions giving rise to the glass. Even at the commencement of crystallisation, the liquid was saturated with biotite and andesine. The vein bears certain close resemblances to the Pseudotachylytes of Orange Free State for which Shand has ascribed a similar mode of origin.

### 15. A note on the Basic Rocks of the northern side of the Chor Mountain (Simla Hills).

A. D. KHARKWAL, Lucknow.

The basic dykes and sills are found to be intrusive into the Boileaugunge Stage of the Jutogh Series, on the northern side of the Chor Mountain of Himachal Pradesh. They are characterised by their limited extent (rarely exceeding 200 ft. in length), occurrence in proximity to the massif of granite and not following any rule as regards their direction. The basic rocks represented by the seven dykes and two sills studied in the area comprise of three types:—dolerites including olivine-dolerite, hornblende-schists and amphibolites with their garnetiferous and epidotic varieties. Pinkish grey olivine of the dolerite dusted with fine granular iron ore material is of special interest as it resembles olivine reported from certain peridotites of Scotland.

These rocks are similar, in their mode of occurrence and petrographic characters, to the corresponding rocks described from the other side of the Chor Mountain, by Pilgrim and West, who regard the hornblende-schists and amphibolites as intrusions younger than the Jutoghs but older than the period of recumbent folding and metamorphism, and the olivine-dolerites and dolerites as later than the metamorphism. This is also found to be true for the basic rocks of the northern side of the Chor Mountain.

### 16. On the rocks in the southern parts of the Ratnagiri district (Bomay).

K. V. KELKAR and S. S. GHODKE, Poona.

The paper contains a description of rocks occurring in Malven taluq and adjacent parts of the Ratnagiri district. The oldest rocks are the metamorphics of the Dharwar Age and include (i) fine grained granulitic gneisses (with quartz, oligoclase, varying amounts of biotite and hornblende, and occasionally garnet); (ii) quartzites (mainly siliceous, rarely ferruginous); (iii) a few bands of crush conglomerates and (iv) hornblende, actinolite and talc-schists.

The metamorphic rocks are cut by a number of pegmatite, quartz and aplitic veins. These minor acid intrusions are apophysal forms of a batholithic Archaean granite gneiss, only portions of the northern fringe of which occur in the area described.

Other important formations in the area are (i) sandstones and quartzites of the Kaladgi age, (ii) Deccan trap—mainly as lava flows and in the form of a few minor intrusions; and (iii) Laterite—mostly secondary.

### 17. A note on a green calcite from the Deccan Traps.

SRIPADRAO KILPADY and P. G. ADYALKAR, Nagpur.

The paper records an unusual occurrence of dark bluish green Calcite with a sub-metallic to schiller-like lustre from the weathered trap hills near the village of Sindi, about a mile west of Wardha town. The colour in hand specimens appears to be idiochromatic on account of its uniform homogeneity, but thin sections reveal that it is actually allochromatic in nature and is due to the presence of finely disseminated submicroscopic inclusions of a green substance. These dusty inclusions which appear to have permeated the entire substance of the calcite appear to be responsible for the schiller-like lustre. Apart from the green colour of the inclusions no other characters could be ascertained under the microscope on account of their sub-microscopic size and consequently the material was analysed for establishing its identity. The chemical analysis has proved that the green dusty inclusions are of chlorite, probably associated with very small amounts of prehnite and radiophyllite (?). This disseminated material constitutes nearly 8.48% of the calcite and appears to have been introduced into it by circulating solutions in the post-hydrothermal stage. The source of the chlorite is obviously from the conversion of the magnesian pyroxene of the trap rock during weathering.

### 18. An Evidence of Dislocation Metamorphism, East of Chamanpur, Keonjhar (Orissa).

G. B. MISRA, Dhanbad.

The dislocation metamorphism as described from the area is the first of its kind to be reported from India. The area east of Chamanpur can be divided into two structural units, the western and the eastern, by a shear zone running nearly N. 20°E.—S.20°W. The rocks of the western unit consist typically of sillimanite zone, pelitic metamorphites, characterised by the abundance of fibrolite. The eastern unit consists of the

'Singhbhum Granite', mostly a biotite granite-gneiss. But in the dislocation zone, a 'metamorphic convergence' is recorded where the petrologically, structurally and stratigraphically different rock types of the two units have given rise to a common quartz sericite rock, characterised by sericite.

### 19. Heavy mineral study of Bundelkhand Granite and associated Gneisses from Mahoba and Kabrai (Hamirpur, U.P.).

R. C. MISRA and P. C. MATHUR, Lucknow.

Specimens of typical pink Bundelkhand granites and gneisses from Mahoba and Kabrai have been subjected to bromoform treatment with or without centrifuging to separate the heavy minerals. The 'Index figure' varies from 3.01—3.67 in the case of simple (uncontaminated) granites, while even the average for gneisses which are regarded to be of hybrid origin is as high as 11.8.

The various minerals identified in the heavy residues are: biotite, hornblende, sphene, magnetite, zircon, apatite, garnet, ilmenite, rutile, epidote and pyrite. Zircon which is more common in granites is euhedral and exhibits a wide range of crystallographic variation. Zoned and unzoned varieties have also been noticed. Perfect crystals of epidote are conspicuous in the gneisses.

Two elements may be differentiated in the heavy residues, one is granitic, the other gneissic. Zircon, apatite, garnet, sphene, magnetite, ilmenite form the granitic elements; while epidote, biotite, hornblende and pyrite are the gneissic elements.

### 19(a). Granitisation of the metamorphosed impure Limestone of Jaggaldaga area, east of Latehar (Palamau, Bihar).

R. N. MITRA, Dhanbad.

The metamorphosed impure limestones occur as intercalated layers or thin bands within the amphibolites, hornblende-gneisses and biotite-gneisses of the area. In most of the places, these calcareous and the associated rocks are seen to be injected by acid leucocratic material. The injection increases in amount towards the south and *lit-par-lit* injection is also seen at places, and there the metamorphosed impure limestones are more intensely affected.

The metamorphosed impure limestones vary from the diopside-bearing crystalline limestones to the types where they contain considerable amount of sphene and andesine. Due to the action of granitising agents, those rocks gradually changed, and the following mineral changes are seen:

Oligoclase first of all takes the place of andesine and finally microcline invades both and becomes the predominating felspar giving the rock a syenitic character. Diopside gives place to hornblende, biotite and chlorite. The extraneous materials added are found as prehnite, apatite, sphene, etc.

The field evidence and the laboratory study show a gradual variation of the composition of the rocks and their transformation is due to the agents of granitisation.

### 20. On some petrogenetic aspects of the cordierite-phlogopite-quartz assemblage from Chailmo Soapstone Quarry (Hazaribagh, Bihar).

B. MUKHERJEE, Indian Bureau of Mines, and A. B. BISWAS, Geological Survey of India.

In course of investigation of the soapstone deposits of Parasnath area, a peculiar cordierite-phlogopite-talc-quartz-schist has been reported to occur in close association with soapstone lenses and quartzo-feldspathic leptites at Chailmo soapstone quarry No. 3 (86°2′: 24°4′). Occurrence of cordierite has not been reported previously from this region. The mineral assemblage is cordierite-phlogopite-tremolite chlorite-talc and quartz. In addition, apatite, zircon, garnet, galena and chalcopyrite are also associated. This peculiar and unusual assemblage of high magnesia rich minerals is rather uncommon and appears to be unique as an Indian occurrence.

The petro-mineralogical study indicates that cordierite and phlogopite started to form under high temperature conditions due to influx of magnesia which consumed alumina and potash contents available in the parental quartzo-feldspathic rock. With falling temperature cordierite and phlogopite were hydrothermally altered to chlorite. The residual magnesia reacted with lime to form tremolite and ultimately to talc through chlorite in presence of aqueous solution.

The mineral assemblage is regarded to have evolved from the magnesia-iron-lime metasomatism of leptites induced by intrusion of granite. Contemporaneous with magnesia metasomatism there was introduction of sulphide ores which formed galena and chalcopyrite.

Optical properties of the different minerals have been worked out in detail showing the presence of optically positive cordierite with (+) 2V between 78°—80° which is of special mineralogical interest.

### 21. A note on the Characteristics and Nomenclature of Composite and Multiple Intrusions.

M. V. N. MURTHY, Geological Survey of India.

In this note the author summarises the distinctive features of composite and multiple intrusions (sills and dykes) and offers some remarks regarding their nomenclature. Composite intrusions consist of highly contrasted rock-types in parallel arrangement. They are flanked by basic igneous rocks (tholeiite, quartz-dolerite, hypersthene-dolerite etc.) which always chill against the country rock. The central acid rock (felsite, granophyre, quartz-felspar-porphyry etc.) however, does not chill against the basic rock and often shows inclusions of the latter along the contact zone between them. Thus, the sequence of intrusion is always, basic first and acid later. The presence of xenocrysts of quartz and felspar similar to the phenocrysts in the later porphyry, often suggests a genetic relationship, leading to the view that basic and acid magmas co-exist in the same magma chamber. The various theories such as progressive differentiation, contrasted differentiation, crustal refusion and thermodiffusion, put forward to explain the origin of these intrusions, are noted. Composite dykes and sills can also result by the intrusion of acid magma of a later epoch into basic dykes of an earlier epoch.

Multiple intrusions consist of more than one basic dyke or sill, arranged parallelly, due to successive injections of magma into intermittently widened fissures. The complex as a whole chills against the country rock; the later injections chill against the earlier. The author suggests that multiple intrusions are most likely during the same epoch of igneous activity when magma is present at a comparatively high level of the crust and there is continued prevalence of tension. Multiple intrusions can also result when magmas belonging to different epochs are injected into the same fissure. These may show cross-cutting relationship and/or association of different types of basic rocks.

To emphasize the distinctiveness of the two types of intrusions, the author suggests that the term 'composite' should be used only to associations of highly contrasted types of rocks and the term multiple for repeated injections of only basic magma. To distinguish the two types of composite and multiple intrusions in which the components (1) belong to the same epoch and are co-magmatic and (2) belong to two different epochs and magma-chambers, the terms 'syngenetic' and 'epigenetic' may be pre-fixed.

## 22. Quartz-sillimanite-muscovite 'Pebbles' in Muscovite-biotite gneiss from Dudhi Tahsil (Mirzapur, U.P.).

M. V. N. MURTHY, Geological Survey of India.

In the gneissic complex of Dudhi tahsil (Mirzapur, U.P.) a narrow zone (50 to 100 ft.) in which 'pebbles', lenses and thin bands of quartz-sillimanite-muscovite rock are irregularly distributed in the muscovite-biotite-gneiss, extends intermittently for over 8½ miles between Kirwil (24°2½′:83°3′) and Kudri (24°3½′:83°9′). Occasional lenses of similar rock are seen in two other localities further south. The 'pebbles' etc., have a highly sheared appearance. The essential uniformity in the mineralogy of the 'pebbles' over the whole zone and also among themselves, the absence of any other rock-types, the occurrence of the same kind of rock as 'pebbles' as well as thin bands in the same locality, discount the possibility of their being sheared sedimentary conglomerates. They appear to result during folding from shearing and rolling of competent bands occurring between incompetent bands. The pebbles west of Kudri, show distinct orientation, their lengths being parallel to one another and pitching towards N20°W. which in fact, is a regional feature as shown by the pitch of the axes of the drag folds in the intensely folded migmatites. It is concluded that the 'pebbles' do not represent sheared bands of quartzites since they are thin in extent and unique in mineralogy in showing the presence of sillimanite which is absent in the quartzites of the vicinity. They seem to represent sheared quartz or pegmatite veins. The source of the sillimanite is doubtful; it is presumably derived from felspar. The following sequence is postulated as a result of study of thin sections. (1) Deformation, when quartz or pegmatite veins were sheared and rolled into distinct 'pebbles' where conditions were favourable. Para-deformation recrystallization of quartz. (2) Crystallization of sillimanite after the recrystallization of quartz during the declining stages of deformation. (3) Post-deformation, introduction of biotite from the gneiss and later introduction of muscovite.

### 23. Mafic Minerals of the Charnockites from India.

P. R. J. NAIDU, Madras.

Rocks from the several Charnockitic areas of India were collected and the minerals separated. These minerals—felspars, amphiboles, pyroxenes, mica and garnet—have been chemically analysed and their optical characters determined. The variations between the optical characters and chemical composition are discussed. The crystallization of these minerals from an initial magma is examined. Subtractive and additive diagrams are constructed to find out if the "Charnockite series" form a consanguineous series. Niggli values for the minerals here analysed, and for the rocks analysed by Washington are projected into a Q-L-M diagram, and the trend of crystallization discussed. Colour index diagrams are prepared and the discrepancy between the anorthite content of the felspar and the colour index of the rocks noticed. Petrofabric diagrams are prepared for quartz, mica, and hypersthene of the rock series and the diagrams indicate close resemblance to similar diagrams of Saxon granulites given by Bruno Sander.

### 24. A preliminary note on the Closepet Granites of Magadi and Kunigal (Bangalore, Mysore).

B. P. RADHAKRISHNA and M. GHOUSE, Bangalore.

An area of 200 square miles in the Magadi and Kunigal taluk lying in the Closepet granite region has been mapped in detail and an attempt has been made to differentiate the granite complex into its several components. Four main types are recognised: (1) porphyritic granite with pink feldspar.porphyroblasts, occurring in the form of pods and lenses in the complex, (2) porphyritic granite with grey porphyroblasts of feldspars, forming a narrow fringe round (1), (3) a uniform coarse-grained grey granite and (4) fine-grained pink granite. A hybrid type of granodiorite occurring in the form of a lenticular ribbon, is described. Other features of interest noticed are the occurrence of cordiorite-hypersthene and quartz-magnetite granulites fringing the western border of Closepet granites.

### 25. On the nature of certain Brick-red Rocks, occupying shear zones in Closepet Granites of Mysore.

B. P. RADHAKRISHNA, Bangalore.

The brick-red rocks occurring in long inlear zones along the eastern margin of the Closepet granites are brecciated and gritty and are mainly composed of fragments of deep red feldspar and quartz healed by veins of epidote, chlorite and calcite. These brick-red rocks are restricted in their occurrence to shear and fault zones in the granites. The red colouration of the feldspars is ascribed to the effect of moving hydrothermal solutions penetrating the structurally weak zone and impregnating the feldspar with pink hematitic dust. Since in other parts of the world, like Great Bear Lake, and the Goldfields area of Saskatchewan, Uranium deposits are found along zones of brick-red rock, a systematic survey with a Gieger counter of the region showing these brick-red rocks is recommended.

### 26. On the origin of Pedestal Rocks of Ganacharpura, Bangarapet Taluk (Kolar, Mysore).

B. P. RADHAKRISHNA, Bangalore.

In the neighbourhood of Ganacharpura, Bangarapet Taluk, Kolar District, weathering of granites of the area have resulted in peculiar mushroom shaped forms. The characteristic features of these granite pedestal rocks are described. It is suggested that the conditions prerequisite for their formation are: (i) coarse jointed granite weathering into spheroidal boulders, (ii) rapidly eroding ground surface which permits demarcation into cap and pedestal and (iii) a hot dry climate with occasional wet periods, promoting chemical weathering which has the effect of rapidly eroding the pedestal nearer to the ground surface. Wind erosion by itself is shown to have had little or no action in their formation.

### 27. A preliminary note on the petrography of Flexible Sandstone.

C. J. R. VARAPRASADA RAO, Geological Survey of India.

The paper deals with the petrography of the flexible sandstone or itacolumite occurring in Jind State, Pepsu. A study of the physical properties of the rock gave the following results:

| | |
|---|---|
| Porosity .. .. .. .. | 21.96% |
| Water absorption .. .. .. | 7.70% |
| Sp. of the bulk rock .. .. .. | 2.15 |
| Sp. gr. of sandstone material .. .. | 2.59 |

From the mechanical analysis it was found that 71% of tye rock consists of fine and medium sand (Wentworth's classification). The chief heavy minerals are ores (magnetite, ilmenite altering into leucoxene), tourmaline and traces of zircon. They constitute 3% of the +120 grade. Under the microscope the rock is seen to consist of 'clusters' of quartz grains with a matrix of clay 'paste', mainly composed of flaky mineral aggregates. The individual grains of quartz are mutually interlocking and very angular.

### 28. On the alteration of the ultrabasic rocks of Ghatsila, Singhbhum.

SANKARSAN ROY, Calcutta.

Sill-like masses, also some dykes of ultrabasic intrusives form low disconnected ridges on the southern bank of the Subarnarekha river, at Ghatsila. The ultrabasic rocks are characterised by various degrees of alteration. The following successive series of mineral assemblages resulting from the alteration of the ultrabasic intrusives in response to continuously decreasing temperature conditions were found:—(a) tremolite-chlorite, (b) chlorite-tremolite-talc, (c) chlorite-talc-carbonate. There is regularity in distribution of the altered phases from the least altered to the most altered beginning from the north-western portion of the ultrabasic ridges towards the south-east.

Minerals of acicular habit like tremolite and minerals of flaky habit like chlorite and talc do not arrange themselves parallel to a particular direction, but are closely felted together. The absence of evidence of stresses acting upon the ultrabasic intrusives implies that the change of temperature assisted by catalytic influence of water and $CO_2$ was the predominant factor in producing the alterations.

### 29. A study of the Epidiorites within the Pelites of Chaibasa Stage around Ghatsila, Singhbhum.

SANKARSAN ROY, Calcutta.

The common feature in the schists of Chaibasa stage is the occurrence of interbedded basic igneous rocks (epidiorites), occurring usually as sill-like masses, rarely as dykes or irregular bodies. Absent in phyllites of Iron-ore stage, but abundant in schists of Chaibasa stage, the epidiorites are composed of long prismatic grains of bluish green hornblende aggregated together, between which small untwinned grains of plagioclase and quartz forming together a mosaic pattern, are interspersed. Epidote and clino-zoisite also occur between amphibole grains. Granules of sphere clustered together are embedded in hornblende. Pale green chlorite with inclusions of hornblende are present. Garnet is absent. Texture is perfectly schistose to gneissose.

From the mineral-assemblage and texture it is evident that the epidiorites belong to 'garnet-zone'. The absence of garnet in epidiorites may be ascribed to the low percentage of FeO, as suggested by Suzuki and Wiseman.

From the relative characteristics (mineralogical and textural) of the epidiorites in the 'staurolite-zone' and the 'garnet-zone' of the associated pelites, we find that there is gradual perfection of metamorphism towards the 'garnet-zone'. The epidiorites near the 'thrust-zone' have undergone low grade alterations, such as chloritisation of hornblendes. It is inferred that the metamorphism of the epidiorites of this area has no connection with the metamorphism of the associated argillites but is related to the metamorphism whose dynamic manifestation is the thrust zone. This phase of metamorphism caused the retrogression evidenced in the associated argillites.

### 30. On the correlation between shape and size of plagioclase crystals in Dolerites and Basalts.

AJIT KUMAR SAHA, Calcutta.

The paper presents the results of a statistical study of the variations in the shape and size of plagioclase crystals in thin sections of 18 specimens of dolerites and basalts. Twelve of the specimens (2 of Deccan Trap basalt and 10 of dolerite dykes intrusive into the Deccan Trap basalt) are from Kakarapar (21°16′ : 73°22′), Gujarat, while the remaining six are from a dolerite dyke in the Jharia coalfield. In the fine and medium-grained specimens, significant negative values of the correlation coefficient between the equivalent radius (i.e. radius of a circle having an area equal to that of the crystal) and the ratio of length to breadth were found. The correlation is not significant in the coarser rocks and also among crystals less than 0.2 mm. in length. A better correlation was found among crystals cut parallel to (001) than among crystals with random orientation.

These studies suggest that the highly anisometric shapes of the plagioclase microlites persist without appreciable change during the earlier stages of their growth. After the crystals have grown to a certain size, a tendency to become equidimensional starts, but this tendency is retarded as the crystals grow coarser and coarser.

The mean values of the length-breadth ratios and the equivalent radii in the 18 specimens give a high correlation co-efficient of 0.811 between the two variables. The following regression equation, which may serve as a basis for the prediction of the mean length-breadth ratio (Y) from the mean equivalent radius (X) of plagioclase in fine- and medium-grained dolerites and basalts has been worked out:—

$$Y = -15.05X + 6.13;$$

the limits of error for such prediction have also been indicated.

### 31. Rocks from the Migmatite Complex of the Kabrai area (Hamirpur, Bundelkhand).

M. N. SAXENA, Lucknow.

A number of traverses in the type area of Bundelkhand granite have brought to light the presence of migmatites on a regional scale. The paper deals with the rocks of one such migmatite complex, near the town of Kabrai (Hamirpur, U.P.)

The rock types met within the area are streaks of simple Bundelkhand granite, garnetiferous leucocratic aplitic gneiss, hybrid gneisses, amphibolites, mica-schists, schistose quartzites and pegmatites.

The probable succession in the descending order is as follows:—

1. Mica Pegmatite.
2. Bundelkhand granites, and hybrid gneisses.
3. Amphibolites.
4. Schists and quartzites.

The rock types give a clear evidence of the phenomenon of assimilation of original schistose country rocks by the granitic magma resulting in hybrid gneisses.

The micaceous schists and quartzites form the original country rocks of area and are of Pre-Bundelkhand Granite age.

### 32. Structural features of the Porphyritic Granite and the Associated Metamorphites, E. Manbhum, Bihar.

SAURINDRANATH SEN, Calcutta.

The porphyritic granite, occurring associated with metamorphites and migmatites in East Manbhum (24°27′45″—24°35′; 86°36′—86°47′30″), occurs as a lenticular band showing, along the major portion of the mass, well-formed planar banding, made evident by alternating bands of feldspar phenocrysts and of the finer grained assemblage. The arrangement of feldspar phenocrysts within the bands may be random or they may give rise to a perceptible lineation which when developed is generally within a few degrees from the horizontal, except for two spots one near Bero and the second near Raghunathpur. The foliation, lineation and associated joints prove to be primary, having originated at a time when the rock was not completely solid.

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The granite shows considerable structural independence from the associated metamorphites and exhibits major structural discordance at the eastern extremity of the exposure. The regional distribution of the flow layers suggest the form of an inclined lens while locally there are two secondary domes proving differential displacement near the two places mentioned. The lineation is for the most part parallel to *b* and its regional pattern gives also an idea of the form of the intrusive. The lineation associated with the two domes are parallel to *a*.

In close contact the wall rocks show mylonitisation and they have developed 3 sets of joints which were in intensity away from the walls. A statistical study of the distribution and concentration of the joints prove a comparatively greater effect of tension close to the wall while the compressive force diminishing at a slower rate than the tension is effective upto a greater distance.

The structures of the granite as well as the wall rocks suggest that the granite was emplaced in its present position with considerable force.

### 33. The geology of the area around Balrampur, Manbhum.

SISIR KUMAR SEN and MRINAL KANTI HORE, Calcutta.

The rock types found in the area are mainly phyllites, mica-schists associated with basic rocks, quartzites etc., with granite-gneiss towards the north. A fault zone stretches roughly E—W within the phyllite country separating the phyllites of the south from the mica-schists of the north. This fault is responsible for sheared phyllites, basic rocks and granites which occur along a wide area.

The phyllites show a gradual increase in the intensity of metamorphism from south to north; beginning from chlorite-muscovite to muscovite-biotite schists with a marked increase in grain size. The associated basic rocks show albite-chlorite-calcite and albite-epidote-calcite assemblages. There are also ultrabasic rocks composed of talc and serpentine.

To the north of the fault-zone, the mica-schists are mainly staurolite-biotite schists. These mica-schists merge gradually to biotite-gneiss which has suffered griessanization at the fringes, giving rise to muscovite-quartz-rocks. The basic rocks included in the gneiss are mere streaks and show a gradual change from coarse epidiorite core to amphibolite and finally to biotite-rich rocks towards the margin of gneiss.

### 34. Hornblendic Rocks from the Auranga-Koel Valley, (Palamau, Bihar).

T. SINGH, Lucknow.

The hornblendic rocks of the Auranga-Koel Valley, lying between (Lat. 23° 52′ : 24° 3′N.) and (Long. 84° 3′ : 84°15′E) include hornblende-hypersthene peridotites, amphibolites, dolerites, gabbros, granulites, diorites, appinites, hybrid gneisses, hornblende granite gneisses, and hornblende quartz rocks. Hypersthene has been discovered only in basic and ultrabasic types.

The formation of diorites, appinites and hybrid gneisses has been attributed to the hybridisation effect of the granitic solutions on the pre-existing rocks.

### 35. A note on the occurrence of Rhyolitic Tuff and other Pyroclastic Rocks at Tattapani (Sirguja, M.P.).

B. B. S. SINGHAL, Banaras.

A group of rocks consisting of rhyolite-tuff and other pyroclastic rocks, occur at Tattapani (23°42′ : 83°40′) as an outlier among the Archaeans. Among the rock types observed are pure glassy rhyolitic rock, lapilli-tuff and halleflinta. The glassy rock was chemically analysed and it has a rhyolitic composition. The pyroclastics of this area have undergone extensive silicification.

The presence of a true rhyolitic glassy rock and coarse pyroclastic rocks near Tattapani indicate that the centre of some volcanic activity was, perhaps, very near to this village. It is significant that none of these rocks show any evidence of metamorphism. The rhyolite-tuff shows a clear flow structure. It therefore seems that the acid volcanic activity of Tattapani corresponds in age with that of the Malani Rhyolites of Rajasthan and with the acid volcanic activity of the Son Valley which belongs to the Lower Vindhyan period.

### 36. An occurrence of Olivine-bearing Metanorite and Metadolerite amongst the Basic Intrusive Rocks of Gomoh, Bihar.

N. V. R. SUBRAHMANYAM and S. P. MATHUR, Dhanbad.

In a previous note contributed to the Poona session of the Science Congress, the basic intrusive rocks of Gomoh area were described. This paper records the occurrence of olivine-bearing metanorite and metadolerite since discovered as small patches among the epidiorites and non-olivine-bearing metadolerites. Olivine forms an essential constituent in olivine metanorite and shows kelyphitic borders: an inner rim of an aggregate of enstatite crystal grains and an outer one, made up of radiate-fibrous-green hornblende. Ortho- and clino-pyroxenes show a very narrow rim of pale green uralite. Calcic plagioclase felspar shows embayed and indefinite margins due to the granoblastic growth of fibrous hornblende. In olivine metadolerite, the reaction rims around olivine are less wide and less frequent due to the finer grain-size of the rock. The pyroxenes have not developed any uralite rim and the felspar still emphasises the ophitic texture. The orthopyroxene often exhibits schillerisation and is seen at places to consist of a core of pale pink and pleochroic hypersthene with cloudy inclusions of magnetite, possibly indicating its partial recrystallisation.

The reaction rims around olivine and pyroxene can be regarded as synantectic structures. The cloudiness in felspars and uralitisation of pyroxenes have resulted from metamorphism. The olivine-bearing metadolerite of this area is similar in mineral composition and stratigraphical position as that of Kodarma area described by Sharma (*Geol. Mag.*, Vol. 77, No. 2, 1940) and the olivine-bearing metanorite is similar to that discovered in Dhanbad area by Sharma and Agrawal and described by the latter in the Proceedings of the 37th Indian Science Congress.

### 37. A note on Chloritoid from Mosaboni, Bihar.

V. VENKATESH and P. D. MALHOTRA, Geological Survey of India.

Coarse crystals of chloritoid occur in a quartz vein traversing mica-schist near Mosaboni. The following are its physical and chemical properties:—

$\alpha$ : 1.718 (light green to yellowish green).
$\beta$ : 1.720 (slate blue or greyish blue).
$\gamma$ : 1.724 (straw yellow to colourless).
$\gamma - \alpha$ : 0.006; $Y > X > Z$ ., 2V : 58 (+).

Dispersion : anomalous. Specific gravity : 3.580.
Both monoclinic and triclinic varieties are recognised, often, in the same grain as intergrowths parallel to the base. In the monoclinic type X coincides with b. The angle $Z \wedge \perp$ (001) varies between 17° and 27°. Polysynthetic twinning with (001) as composition plane, and [310] and [110] as the twin axis is common. Other twin laws are also recognised.

The effect of heat on the optic properties of the mineral is described. A chemical analysis conforms roughly to the empirical and structural formulae for the mineral.

### 38. Study of certain Tertiary Sediments from near Agartala, Tripura State.

A. B. BISWAS and S. K. DEY, Calcutta.

The paper embodies the results of the laboratory study of certain samples of Tertiary sediments collected from near Agartala (23° 45′45″ : 9° 22′30″), Tripura State. The loose, friable and practically unconsolidated sandy aggregates are classifiable into two types on the basis of their physical properties. One type is pale cream in colour, soft and micaceous, while the other type is reddish yellow showing profuse development of authigenic iron hydroxides. The results of size grade analyses reveal that the sediments are of the composite type varying from sand, sandy loam, sandy silt to gravely sand. They are of fine texture except the gravely sand with a median of 0.33 mm. The samples show different degrees of sorting as revealed by the widely variable coefficients of sorting or '$S_0$' for different samples. The sandy silt (No.4) is very well sorted with a '$S_0$' value of 2.4, the sorting of the samples of sand (Nos. 1 and 2) appears to be normal, while the sandy loam and gravely sand (Nos. 3 and 5) are very badly sorted with high '$S_0$' values. The gravely sand shows a polymodal distribution while others are bimodal. From the nature of the size-distribution it is suggested that the transporting agency suffered fluctuation in velocities contemporaneous with sedimentation.

The heavy mineral assemblage shows the presence of black opaque ores such as ilmenite, magnetite and leucoxene together with sillimanite, kyanite, staurolite, tourmaline, zircon (both pink and colourless), rutile, andalusite, garnet (both pink and colourless), epidote and biotite. The lithological characters, nature of the heavy minerals as also the evidence of fossil wood suggest that the Agartala sands may be correlated with the Upper Dupi Tila Stage of the Tipam series of Assam.

### 39. On the occurrence of Calc-granulites and Calc-gneisses in Chikla area (Bhandara, M.P.)

S. A. BILGRAMI, Quetta (Pakistan).

The paper records the occurrence of calc-granulites and calc-gneisses in Chikla area, which form a 50 ft. thick band and have not been described by the earlier workers on Chilpi Ghat Series, under which the rocks of the area have been classified by Fermor. These rocks are chiefly composed of diopside, quartz, soda and potash felspar, calcite and some accessory minerals like epidote, zoisite, actinolite and spene.

### 40. The Rise of the Central Satpuras.

S. K. BOROOAH, Nagpur.

In this paper, the author has tried to show that the present Mahadeva hills or Panchmari hills of the Central Satpuras are geologically of recent elevation. Although the probability of the existence of a mountain range in Pre-Cambrian times, in the region of the present districts of Nagpur northern, Bhandara and Balaghat in Madhya Pradesh is fully recognized; at the time of deposition of the Talchir tillites, the country was worn down to base level and troughs were formed for the reception of the Gondwana sediments. These materials were derived from the disintegration of the uplifted peneplain due to the removal of the Ice sheet.

Breaks in deposition occurred at the end of the Bijori and Jabalpur periods. The final uplift of the hills in the shape of a dome commenced sometime in Eocene. The major axis of the fold runs north-north-west—south-south-east, the other being the old Dharwarian axis trending roughly East and West.

### 41. Sclerotia in Indian Coals.

D. CHANDRA, Krefeld (Germany).

The presence of sclerotia in Indian coals is not uncommon. So far only two Indian coals,—the Palana lignite, Bikanir, and the Poniati seam, Raniganj—have been studied, and both of them contain Sclerotia of different forms. In Palana lignite Sclerotites brandonianus Jeffrey and Chrysler, and Sclerotites crassitesta Stach, have been found, whereas in Poniati seam a new type of notched sclerotium (Sp. nov.) is present.

The whole investigation was carried out in reflected light under oil immersion lens.

### 42. On the Stratigraphy of the Bijawar Series in the type area of Bundelkhand.

M. S. CHAUDHARY, Banaras.

A systematic geological mapping of the Bijawar outcrop in Bundelkhand, occurring between lat. 24°18′ and 24°40′ and long. 79°8′ and 79°53′, has been carried out on 4″=1 mile scale. The Bijawar Series is traversed by long parallel strike faults which are responsible for many repetitions of beds and the consequent increase of width of the outcrop of the

Bijawar series, in spite of its having only a few components. The northern boundary has also been modified by strike faulting and does not represent the original limits of the basin. On the west where the Bijawars have more or less their maximum development, they are suddenly brought in contact with granite, due possibly to a dip fault. In the western portion of the area an intrusive granite is also found which has cut across the Bijawars and produced hybrid rocks. This granite is reported for first time and is believed to be equivalent to post—Delhi granite (Erinpura granite) in Rajasthan. The following is the succession worked out for the Bijawar Series of Bundelkhand.

| | | |
|---|---|---|
| Upper Bijawars | Iron stone shales | 0-100 ft. |
| | Shahagarh limestone | 0-300 ft. |
| | Sandstone and intercalated shales | 0-150 ft. |
| | Bajna limestone | 0-300 ft. |
| Middle Bijawars | Conglomerate-shale group showing graded bedding | |
| | Conglomerate-sandstone group showing graded bedding | 150-600 ft. |
| Lower Bijawars | Quartzite with enormous chert and jasper beds and intercalation of limestone and contemporaneous lava flows | 0-400 ft. |
| | Basal conglomerate | 10- 25 ft. |

## 43. Late Pre-Cambrian Glaciation and its relationship with the Bijawar series in the type area of Bundelkhand.

M. S. CHAUDHARY, Banaras.

Occurrence of a typical tillite bed in Bijawar series of Bundelkhand (between lat. 24°18′ and 24°40′; long. 79°8′ and 79°53′) re reported. The boulder bed, in Eastern limits of Bijawar series, where it is most typical, occurs above the Bijawar beds and below the Semri Series, but laterally it changes its nature to conglomeratic sandstones and shales showing graded bedding, the shales show varve structure.

The boulder clay in its typical section over 20 miles length, is totally unstratified, the thickness being about 150 ft. and it is chocolate brown in colour. In the clayey matrix are sparsely studded rock fragments of conglomerate, sandstone, quartzite, chert, jasper, basalt, limestone representing the lithology of the lower Bijawars, and of granite representing the Bundelkhand granite. The rock fragments vary from microscopic size to 3 ft. across, and must have been brought from at least 20 miles distance. The embedded rock fragments show very distinct facets developed (soled) and a few are also striated. Very perfect graded bedding has been observed in the beds which laterally represent the tillite. More or less typical varves and megavarves are reported, and each unit or varve definitely indicates the seasonal influx of sediments, that was controlled by glacial melting.

The tillite is shown to be the work of land ice which deposited its content in very shallow sea. The inferred glaciation is correlated with late pre-Cambrian glaciation known in China, Australia, Africa, Norway, Scotland, Spitzbergan and North America. Here it occurs a little low in stratigraphical scale.

### 44. Age of the Saline Series, Salt Range (W. Punjab, Pakistan).

A. K. GHOSH and A. BOSE, Calcutta.

On the evidence of micro fossils of vascular plants in the Saline Series, Salt Range, the age of the Series has been assigned to the Eocene. This raised a good deal of controversy as the geologists considered it as irreconcilable with the field evidence. It was suggested that examination of rock samples from undoubted Cambrian age might lead to a satisfactory conclusion. The authors in previous communications in this section of the Science Congress referred to the recovery of vascular microfragments from the Cambrian beds of Salt Range and also of Kashmir.

Since then the attention of the authors have been drawn to the publications of Naumova (1949), Ressinger (1939, 1952) and Koplevitch (1951) who have also recorded vascular microfragments from the Cambrian beds of U.S.S.R. and Esthonia.

Taking all these facts together it appears that the phylogeny of vascular plants can be traced back to the Cambrian times and that the age of the Saline Series may not require any modification on palaeobotanical evidence.

### 45. Stratigraphical and Palæontological features of the formations occurring in Zewan and Risin Spurs of Kashmir.

A. S. KALAPESI and H. R. BANA, Bombay.

A detailed Stratigraphical and Palaeontological study of the formations belonging to the Permo-Carboniferous and the Lower Permian System was undertaken in 1945. The paper gives a 'resume' of the work carried on in the region near about Srinagar.

The sequence of the beds at Zewan and Risin Spurs in order of antiquity is tabulated below:—

| | |
|---|---|
| 6. Zewan beds of shales and limestone with siliceous partings | Zewan series of Permian System |
| 5. Shale: fossiliferous | Permo-Carboniferous System. |
| 4. Limestone and shale beds with siliceous partings | |
| 3. Shale: White Gangamopteris shale | |
| 2. Novaculite (flinty rock) | Middle and Upper Carboniferous System. |
| 1. Andesite, Panjal-Trap Rock | |

Some of the fossil specimens found in the Gangamopteris shale beds of the Permo-carboniferous system of the Risin Spur are worth recording here:—

(i) Plants:—*Gangamopteris orisinensis* sp. nov. (?); *Palisslya indica sp. ind.* Oldham; *Otozamite aff. hislopi,* Oldham;

(ii) Insects:—*Prognoblattina Columbiana* Schudder;

(iii) Fishes:—*Amblypterus kashmirensis,* Woodward; *Palaeoniscus sp. ind;*

(iv) Trilobita:—*Esteria risinensis** (?) *sp. nov; Cypridina sp. ind.* The last named fossil is not identified for its species nomenclature; the fossils marked with * (an asterisk) in the above list indicate a new species nomenclature which can be finalised after further work on similar specimens.

The following are some of the fossils from the topmost beds of the Zewan series of the Permian System exposed at the Zewan Spur:—

(i) Brachiopoda:—*Leptodus aff. tenuis,* Waagen; *Products cf. scabriculo,* Martin; *Spiriferina zewanensis,* Diener; *Aulosteges tibeticus,* Diener, *var, zewanensis; Chonetes lissarensis* Diener; *Hemiptichnia himalayensis,* Waagen;

(ii) Lamellibranchia:—*Oxytoma laticostatus, Netschajew, var. zewanensis; Parallelodon zewanensis sp. nov; Astartilla transversa,* Dana;

(iii) Polyzoa (Bryoza):—*Fenestella sp. ind. aff. pleibeia,* Mc Coy; *Protoretepora ampla, Lonsdale;*

(iv) Corals:—*Thamniscus sp. ind. aff. furcillatus,* Ulrich; *Amplexus coralloides,* sow. *aff. abichi,* Waagen;

(v) Spongia:—*Amblysiphonella (?) sp. ind.*

(vi) Trilobita:—*Dipleura (?) sp. ind. aff. dekayi,* Green, and many others.

### 46. Studies in Pleistocene Glaciation in the Eastern Himalayas, III.

N. R. Kar, Calcutta.

The present paper is a continuation of two previous communications published in the Proc. Ind. Sc. Cong., Pt. III, Poona (1950 and Bangalore, 1951), and deals with the interesting problem of lowest limits of glaciation in this part of the Himalayas between the river Chel and Daina and the southern part of Kalimpong and Bhutan hills.

The lowest limit of glaciation in this part of the Himalaya comes down to about 550 ft. at the Himalayan foothills and about 10-12 miles away from them. The field evidences traced by the author in support of this lowest limit of glaciation are: (a) there is a terminal morainic ridge with pinnacled tops attaining the height of 250 ft. and steeply overlooking the flat outwash plains beyond, which suggests a sort of plastic flow of the ice-medium rather than a sub-aerial medium, (b) these drift deposits are not limited to the foothill zones as in the case of a piedmont deposit, but have been found to cover the higher hills upto an altitude of 6000-7000 ft. where all the stream and river valleys have been found to be filled up by these drifts thus suggesting that the source of the drifts lies not in the foothills but in the higher hills of Inner Himalayas, (c) there is ample evidence of recurring melting phenomena just at the front of the terminal moraines and near it in the form of a succession of purely meltwater sands, partly sorted fluvio-glacial sands and pebbles alternating with non-sorted glacial till. In some places occurrence of horizontally banded sands of typical varved character and implying a recurrent summer and winter melting of the depositing medium have been traced, (d) an enormous deposit of fresh melt-water sands over an extensive area and extending for 12-14 miles just in front of the terminal moraines has been recorded.

All these features suggest a vigorous and recurrent melting of the depositing ice-medium, a fact quite unaccountable in the case of a piedmont deposit of subaerial origin.

### 47. An attempt at the classification of the Pre-Vindhyan sediments of southern Mirzapur District, U.P.

S. M. MATHUR, Geological Survey of India.

The "Transition Series" of R. D. Oldham and E. Vredenburg, south of the Son river in the Mirzapur district, has been classified into two rock groups which have been further divided into four stages, three in the lower group and the remaining one in the upper. The former group is composed mainly of jasper beds, quartzites, banded hematite-quartzite, shales and calc-chlorite-schist. The latter group is made up almost entirely of shales with minor variations of phyllite and slate. Relict outcrops of a younger conglomerate and breccia are found topping some of the hills of shales of the latter group.

### 48. A note on the stratigraphy of Joda area (Keonjhar, Orissa).

G. B. MISRA, Dhanbad.

The paper deals with the stratigraphic sequence based on detailed field evidence, as well as heavy mineral study of some of the sedimentary rock formations in the area. The salient features in the stratigraphic sequence as established by the author are: (1) the sub-division of the Iron Ore Series into an older member, the Basal Sandstone, unconformably overlain by the sub-aerially deposited Lava, Shale and Banded Hematite Jasper rock; (2) the inclusion of the Kolhan conglomerate in post-Dharwar (pre-Cuddapah) period; and (3) the establishment of the stratigraphic dissimilarities between the Newer dolerites and the Lavas, as well as the Kolhan conglomerates and the Basal Sandstones based on lithologic and petrographic evidences.

### 49. On the Quartzites of Nathdwara-Eklingji area (Mewar, Rajasthan).

T. V. V. G. R. K. MURTY, Udaipur.

Quartzites of the area are known to belong to the Aravallis and the Delhis. The Delhi Quartzites are found to be associated with grits at their bases, which are considered to be the basal beds of Delhis. The present study shows that these grits are not normal sedimentary formations but only a crushed facies of the quartzites. The study of the pebbles in the grit has shown that they are derived from the Delhi Quartzites. The grits therefore must be later than the Quartzites, and in the nature of a crush breccia of a later orogenic period.

A remarkable feature in this area is the occurrence of huge masses of vein quartz spread over both on plains and on hill tops. A close study of the quartzites which have got similar occurrence, in relation to the quartz veins, has shown that the vein-like quartz masses are in most cases only recrystallised quartzites.

A study of the Aravalli quartzites and the Delhi quartzites has shown that there is practically no difference in their occurrence in lithology and even microscopic characters. It would therefore be possible that the various quartzites mapped as Aravallis and Delhis may ultimately belong to the same stratigraphic formation.

### 50. On the Limestones of Nathdwara-Eklingji area (Mewar, Rajasthan).

T. V. V. G. R. K. MURTY, Udaipur.

Limestones are common members of the Aravallis, Rialos and Delhis in Rajasthan. In this area, limestones of Aravallis and Rialos are known to be present whereas limestones of Delhi age are not reported. A close study of the various limestones of the area failed to show any difference in their lithologic characters. On the other hand, their field occurrence, chemical composition and associated rock-formations and mineral deposits all appear to be similar, which shows that we have here different bands of the same stratigraphic formation under different structural relationships.

### 51. On some sedimentological aspects of the Tertiary Sandstones near Bagrakote (Darjeeling, Bengal).

SATYABRATA RAY, Howrah.

The thick Tertiary sedimentary formation of the area, which has been correlated with the Nahan Series (Siwalik) by Mallet, consists of fine-grained micaceous and feldspathic sandstones with intercalation of conglomerate beds, and dips nearly 30° towards N.E. The common indications of its being fluviatile deposit with a control of sedimentation by seasonal distribution of rainfall, have been found. The heavy mineral analysis of specimens collected across the dip along two sections, the Lish and Churanthi valley, was carried out. Among the minerals biotite and chlorite, which again form a rather gradational series in their characters, are the most predominant ones. Other important minerals are garnet, tourmaline, apatite, staurolite, etc. In both the sections a break in the continuity of the frequency curve has been found in case of most of the minerals and at a more or less particular position. In case of Lish valley, the break conforms well with a lithological dissimilarity and difference in absolute percentage of heavy minerals between the two parts and in that it may be considered as a stratigraphical break. But in the other section, it can be better explained as due to a horizontal dip fault, thereby thickening the conglomerate bed here and showing an imperfect similarity in the trends of the curves in the two parts.

### 52. A note on the Stratigraphy and Palæontology of the Kayia Hill of Kutch.

V. D. SHUKLA, Banaras.

The mapping of the Kayia hill (23°36′-23°39′:69°10′-59°13′), northwest of Bhuj, has been carried out on a scale of 4″=1 mile. The rocks are exposed in the form of a denuded dome with high dips to the north and gentle dips to the south. The core of this dome is occupied by an igneous intrusion which has affected the beds adjoining it. Besides this, a number of doleritic and basaltic dykes are also seen traversing the dome. The sedimentary rocks consist of mostly shales, sandstones and limestones belonging to Patcham and Chari series. With a view to zoning in detail, these rocks, on lithological basis are divided into twenty beds. These rocks are highly fossiliferous and fossils have been collected bed by bed. The present collection of fossils consists of Caphalopods, Lamellibranchs, Brachiopods, Gastropods and Echinoids.

### 53. A study of the Jurassic Lamellibranchs of Kutch.

V. D. SHUKLA, Banaras.

During the field work done in the year 1927, a large collection of invertebrate fossils from the Jurassics of Kutch, was made by Dr. Rajnath. Out of this collection, a detailed study of the pelecypods has been carried out by the author under the guidance of Dr. Rajnath. The various families present in this collection are Nuculidae, Parallelodontidae, Trigoniidae, Pectinidae, Spondylidae, Limidae, Ostreidae, Astartidae, Mitylidae and Isognomonidae comprising of 28 genera and 52 species; out of which a number of them are found to be new species.

### 54. The Miocene beds of Bhuteshwar, near Gogha (Saurashtra).

SUKHBIR SINGH, Lucknow.

No definite horizon has so far been assigned to the Calcareous grits described by Dunn and others from around Gogha. In this paper, the author reports the discovery of *Miogypsina* and *Miogypsinoides* in these grits exposed in the stream west of Bhuteshwar. These foraminifera indicate a post–Burdigalian age of the beds.

### 55. Dadoxylon Sahnii Sp. nov. from the Olive Shales of Salt Range (W. Punjab, Pakistan).

S. N. SINGH, Lucknow.

The present paper describes a new species of *Dadoxylon* from the Olive Shales of Salt Range. The characters for specific differentiation are the number of pits in the medullary rays, biseriate in the middle and the number of pits in the field with a tendency to aggregate in the centre. This is the first *Dadoxylon* to be described from the Salt Range.

### 56. Foraminiferal Genera and Species from the Kirthars near Kolayat (Bikaner, Rajasthan).

S. N. SINGH, Lucknow.

Discovery of Kirthar horizon in Rajasthan was first reported by me in 1951 (Current Science—Vol. XX, p. 230—September, 1951) and this preliminary report deals with the results of the investigations of the foraminiferal fauna of this bed which I have been carrying out under the guidance of Prof. S. R. N. Rao.

The present fauna consists of seven species of *Nummulites* consisting *Nummulites maculatus* and *N. stamineous* which fix the age of this bed as lower part of middle Kirthar. The family *discocyclinidae* is represented by the following sub-genera: *Discocyclina, Actinocyclina* and *Proporocyclina*. Many of these have been recognised to be undescribed species. The sub-genus *Proporocyclina* is now reported for the first time from the Indian region.

Besides the above mentioned, there are present the following:—*Dictyoconoides cooki, Flosculina sp., Heterostegina sp., Calcarina sp., Gypsina sp.,* etc.

In thin sections two other forms showing a close affinity to *Eoconuloides* and *Eoannularia* has been noticed. The calcareous algae *Archaeolithothamnium* is also present in rock sections.

### 57. Genus Linderina in the Kirthar formations of Kolayat (Bikaner, Rajasthan).

S. N. SINGH, Lucknow.

The paper gives a description of three species of *Linderina* discovered in the Kirthar formation near Kolayat. *L. rajasthanensis* and *L. bikanerensis* are considered to be new and the third is referred to *L. aff. brugesi* Schlumberger.

Very little is still known of the structure and affinities of this well-known Eocene genus and the present record from India is of considerable importance.

### 58. Geology of Balaghat Area (Madhya Pradesh).

N. V. R. SUBRAHMANYAM and T. S. RAO, Dhanbad.

The paper embodies the geology of the country around Bharweli village near Balaghat. The structure of the area has been studied in detail and the country rocks which are of Dharwar age, are distinguished stratigraphically to belong to the older Sonawani Series and the younger Chilpi Ghat Series. Sills of acid and basic intrusives are noted in the Sonawani series.

The Sonawani series consists of calc-gneiss and phyllites. The presence of microcline as the predominant felspar in the calc-gneiss is explained to be due to later injection. The compact phyllites consist of zircon and tourmaline as accessories.

The Chilpi Ghat series begins with a conglomerate bed, which is surmised to be of sedimentary origin by the heterogeneity of its pebble content and field characters. The black and red jaspery quartzites succeed the conglomerate and are overlain by the manganese ore band having a lenticular shape. Where the latter peters out along with quartzite, phyllites directly overlie the conglomerate. The phyllites show much plication and consist of ottrelite, rutile, ilmenite and tourmaline as accessory minerals.

The intrusive rocks are only confined to the older Sonawani series, conforming to its strike and hence are considered to be sill-like in nature. Oldest among these, is the schistose biotite granite-gneiss with allanite. The basic intrusives are represented by meta-dolerite, epidiorite and meta-gabbro, having passed through the 'end-stage alterations'. Charnockitic types among them are due to contamination with the aluminous sediments of the Sonawani series. Augen-gneiss is the youngest in age and has resulted from the injection of potash-rich solutions into biotite-rich granite-gneiss. A mylonite granite is also described, showing characteristic features of mylonitisation.

### 59. The Eocene Genus *Hantkenina* Cushman in Kutch.

B. S. TEWARI, Lucknow.

The pelagic spine-bearing foraminifera, *Hantkenina* which is a key genus for the Eocene beds has been discovered for the first time from

India. The genus *Hantkenina* has a wide geographical distribution and it is known from the region round the Mexican Gulf, the Mediterranean region and Indonesia. A new species *Hantkenina* (*Aragonella*) *Kutchensis* has been described. It has been procured from the clayey limestone occurring north of the village Miani (24° 4′ : 69° 8′), south-western Kutch, India. The new species occurs in association with other Kirthar (Lutetian) fossils such as *Nummulites stamineus, N. obtusus, N. acutus, Alveolina elliptica, Discocyclina dispansa, D. sowerbyi, D. javana var. indica, Dictyoconoides cooki, Halkyardia sp.*, and *Linderina sp.* The two latter genera are also new to India. The clayey limestone containing these fossils have been assigned to the lower part of the Middle Kirthars.

### 60. Tertiary Pollen from Lingnites of Palana, (Bikaner).

K. P. VIMAL, Lucknow.

Some samples of lignites collected between 2-4 feet below the upper surface of a 20 feet thick coal seam in Palana, Bikaner, were macerated for microfossils. These include a number of spores and pollen and these are figured and described in detail here under the following names:—

*Nonaperturites, Monocolpites, Tricolporites, Tetracolporites,* each with one sporomorph; *Triorites* and *Hexacolpites* each with two sporomorphs; and *Tricolpites* with about 12 sporomorphs. Out of these, *Nonaperturites* spm. 1, *Tricolpites* spm. 1, *Hexacolpites* spm. 1, *Tricolporites Tetracolporites* spm. 1, *Triorites* spm. 1, *Trioritas* spm. 2, can be compared respectively with the pollen of *Potamogeton, Quercus, Nothofagus, Myrsine Tilia, Betula* and *Proteacidites.*

It is found that the *Tricolpites* type of pollen are more numerous while the *Nonaperturites* are the rarest. Some of types like *Triporites* spm. 1, *Tricolpites* spm. 1, *Hexacolpites* spm. 1 referred to above have been observed in sample 2 (Rao and Vimal, 1951. Ind. Sci. Congress) also. Pollen similar to some of the types described in the paper are found in the Tertiary deposits of Australia and America (Green River oil shales).

### 61. Physical and Refractory Properties of Talchir Shale, Jharia Coalfield.

Y. K. AGRAWAL, Dhanbad.

The Talchir shale is hard and non-plastic and ordinarily it does not develop sufficient plasticity even on soaking with water for 7 days. Its tensile strength is 43 lbs. per sq. inch and fusion point is about 1125°C. It can thus be used after being ground, for the manufacture of good quality bricks for building purposes. As regards its utility for refractory wares, it can only be used as a part of a mixture, by blending with other clays which have similar fusibility but are more plastic.

### 62. Elastic behaviour of some Indian rock-specimens.

S. BALAKRISHAN, Waltair.

Elastic constants of rocks which are in the nature of polycrystalline aggregates are dependent on the randomness of arrangement, closeness of packing, particle size and mineralogical composition of crystallites or granules composing the aggregates.

The paper gives the elastic moduli and other relevant features obtained from measurements on sound velocities in about a dozen specimens of Indian rocks. This systematic investigation of the ultrasonic sound velocities (longitudinal and torsional) in various rock sections by the wedge method, has shown that the differences in granular structure and mineralogical composition from grain to grain are reflected in the transmission patterns that are obtained. Typical cases like limestone, consisting of practically the same chemical substance all through the section, give intense ultrasonic patterns with a large number of diffraction orders. In these rocks, it has been possible, by special techniques, to determine both longitudinal and torsional velocities. Cases like granite, on the other hand, consisting of a variety of materials like mica, felspar and quartz give weak ultrasonic patterns and appear to scatter the sound to a large extent. Torsions are not easy to excite in these cases. There is a further point of interest that in these rocks, the transmission maxima are fairly broad unlike what we get in metals and single crystal plates where they are generally sharp.

### 63. Geology of the area around Daltonganj (Bihar) with certain observations on the coal occurrences.

S. P. DAS GUPTA, Calcutta.

The area forms a part of the Chhotanagpur granite-gneiss terrain in which lower Gondwana sediments were deposited in basin like depressions having E-W structural alignment like that of the Damodar-Valley Coalfields.

The Archaean rocks consist of migmatites, gneisses and granites, the latter showing gradual variation in textures from a fine-grained aplitic to coarser pegmatitic ones with corresponding minor change in their mineral composition. The granite gneiss contains inclusions of the sedimentary metamorphites consisting of mica schists, crystalline limestones, calc-silicate rocks and also of meta-dolerites, epidiorites and amphibolites. Due to varying amounts of incorporation and assimilation of country rocks, metamorphic minerals like sillimanite, garnet, hornblende, sphene, etc., have been developed in granites.

Non-diastrophic sedimentary features like clay-pellets, current bedding, ripple marks (?), minute folds, penecontemporaneous conglomerate etc., throw much light on the history of the lower Gondwana sedimentation.

The coal which occurs in the northern part of the area, is non-caking and medium volatile type and the ash in it varies from 12 to 31%. Washing of coal (19.40% ash; 6173 calories) using a liquid of sp. gr. 1.58 gives a good (71.3%) recovery. The ash contents and calorific values of float and sink are 13.37% and 34.21%; and 7655 cal and 5577 cal respectively. Total sulphur content of the coal is found to be 0.15 to 0.18%. Analyses show that pyritic sulphur in the coal is greater in proportion than sulphate sulphur and organic sulphur. Both combustible and fixed sulphur predominate over non-combustible and volatile sulphur respectively.

### 64. Microscopical study of the Germaniferous Sphalerite from Nepal Himalayas.

S. DEB and B. C. MUKHERJEE, Jadavpur.

Polished sections of several specimens of Sphalerite collected by Prof. S. N. Bose of Calcutta University, were examined. Chemical and X-ray studies has shown the presence of Germanium.

Microscopic study has revealed that the sphalerite is grey, isotropic and is present in big patches. Some crystal outlines are seen. Next mineral is magnetite, which is of light grey, rather creamish colour, high relief without any cracks or pitted surface and is always associated with patches of sphalerite. This mineral is isotropic and seems to be the primary mineral of the ore-body.

Magnetite was separated from the sample electro-magnetically, after grinding. This magnetically separated magnetite has always associated with it, a mineral which shows pinkish grey colour. The mineral is idiomorphic and has a high relief with slightly pitted surface and is almost isotropic. This is the mineral which is probably Germanite $Cu_3(Fe,Ge)S_4$, as it has identical microscopical characters shown by a known sample of Germanite containing about 9% of germanium, from East Africa. Detailed study is in progress.

### 65. The Steatite Deposits of Rajasthan and their origin.

V. S. DUBEY and K. D. BHARGAVA, Banaras.

In this paper a detailed study of all the important talc deposits of Jaipur, Jodhpur, Udaipur and other divisions of Rajasthan has been made both in the field as well as in the laboratory. As a result it has been found that these talc deposits always occur associated with the Raialo dolomite where the latter has been intruded by the basic intrusions, now represented by amphibolites. Always on both sides of an amphibolite dyke, there is a few feet thick chlorite and this chlorite merges into steatite. This contact effect is found upto 40 to 50 feet from the dykes. It appears that the hydrous solutions emanating from the dykes have reacted with the dolomites, leaching away calcium carbonate and adding silica to the remaining magnesia. Chemical equations have been given to explain the formation of chlorite and of talc from dolomite by the hot waters emanating from amphibolite. The amphibolite and the associated chlorite and steatite have been chemically analysed. The amphibolite gives a composition of ultra basic rock on analysis.

### 66. Mineral Survey and Mapping of the Schist Belt in Krishnarajapet taluk (Mandya, Mysore).

K. GAVISETTY, Bangalore.

The paper gives an account of the geology of Krishnarajapet Taluk in Mandya district, Mysore State. The area has been mapped on a scale of one inch to a mile and the occurrences and inter-relationships of the several rock types (hornblende-schists, tremolite-actinolite schists, quartzites, limestones, gneisses and granites) have been delineated in the map. Among the minerals of economic importance reported are the occurrences of chromite, asbestos, beryl, corundum, felspar, kyanite, muscovite, quartz, soapstone and building stones.

### 67. The Soils and the Irrigation Problems of the Northern Karnatak (Bombay).

R. V. JOSHI and M. S. SABNIS, Dharwar.

The observations regarding the soils of a part of the Bombay Karnatak, given in this paper, are based upon the field-work and the laboratory tests carried out by the authors. It appears that the old land-form over which the present soils rest is uneven with buried valleys and ridges lying below the soil cover. The texture of these soils also shows a great variation. The accumulation of alkalies from subsurface water at different depths is mostly due to these characteristics of the soils. Due to efflorescence these salts often come to the surface and damage the fertile soils. It is highly desired that the soild-profiles should be studied in detail at as many places as possible which would give a fairly correct idea of the varied soils that are to be irrigated in future.

### 68. A note on the occurrence of Calcareous Tufa near Badami (Bombay).

R. V. JOSHI, Dharwar.

R. Foote has recorded the occurrence of a fairly extensive formation of calcareous tufa south-east of Badami (Bijapur district), but he was unable to trace its relation with the underlying rock formations. In the recent survey of the Malaprabha basin, the sections in the pits and well were studied which showed that this is not an *in situ* deposit but a water-laid deposit favoured by the swampy conditions. It is found usually at the junction of the Saraswati-Halla and the Malaprabha River and along the banks of the former. The chemical and mineralogical characteristics of this deposit are discussed in the paper.

### 69. An occurrence of Graphite in Todupulai, Northern Travancore.

K. K. MENON and K. V. KRISHNAN NAIR, Trivandrum.

The field observations made in regard to an occurrence of graphite near Karimannoor in Northern Travancore are briefly discussed in this paper. The area is mountainous and is traversed by flat-topped parallel ridges of the Western Ghats trending in a NW-SE direction. The graphite occurrence under reference is exposed on the summit of a low ridge. The country rock is a garnetiferous gneiss representing the Archaean metamorphic rocks in Travancore. This has been intruded by a coarse-grained pegmatite having a width of fifty feet or more. Hand-specimens from the area of intrusion show abundant graphite flakes oriented parallel to the foliation of the gneiss, quartz, felspar and micas in decreasing order of abundance. It is considered that the mineral is likely to be found at depth in lenticular bodies along foliation. The pegmatite is also seen to carry stringers of graphite particularly confined to the peripheral region not far away from the gneiss. Comparison with graphite occurrences in Southern Travancore tend to support the view that there may be pocket-like bodies of graphite existing at depth.

### 70. On the Genesis of Soapstones of Parasnath area (Bihar).

B. MUKHERJEE and V. R. KHEDKER, Damodar Valley Corporation, (Geology Division).

In the field season 1949-50 and 50-51, prospecting for soapstone was undertaken by the Geology Division, D.V.C., in the areas adjoining Parasnath hill in Hazaribagh and Manbhum Districts of Bihar. Six new occurrences along with two existing ones were surveyed in detail.

Soap-stone occurs as lenticular bodies in schists and leptites, rock-types considerably deficient in magnesia, and have the typical mineralogical association, talc-tremolite-phlogopite-antigorite-quartz. Ultrabasics are entirely absent and the basic types are represented by amphibolites and hornblende schists. Calc-silicates are also absent excepting the tremolite or tremolite-actinolite bodies in the lenses. Serpentines scarcely occur. A zonal arrangement of the lenses from a tremolitic core to an outer chloritic shell through shells of talc and talc-phlogopite is conspicuous. Presence of a hydrothermal solution which may have played a considerable part in the genesis of the soapstones is detected by the presence of minerals like tourmaline, apatite, grossularite, sulphides and magnetite in the lenses which are otherwise absent in the country rock.

The genesis is regarded to be due to:—

1. Either selective movement of magnesia and alumina originally present in the parental body in fluid phase in the presence of hydrothermal solution,

   or

2. Selective movement of magnesia incorporated by the hydrothermal solution and alumina of the parental quartzo-feldspathic rock in the fluid phase with falling temperature.

### 71. Gamma activity of Zircon crystals from a Syenite in Southern Travancore.

K. VISWANATHAN NAIR and K. V. KRISHNAN NAIR, Trivandrum.

Near a place called Kizhkulam, there is an occurrence of a hornblende-syenite in the form of a low ridge striking N.W. and conforming with the general strike of the surrounding country rocks, which are the charnockites and the garnetiferous gneisses, the latter predominating. On account of the accumulation of talus material, it has not been possible to trace the contact features between the syenite and the surrounding rocks. The syenite is composed of felspars and hornblende with accessaries like zircon, epidote, ilmenite, apatite, sphene, mica, and sulphide ores. Zircon occurs locally as large euhedral crystals attaining a length of two to three inches.

The radioactivity of these crystals in a finely powdered condition was estimated using a Gamma Counter. It was compared with that of an equal weight of thoria and from the data the amount of thoria in the zircon has been calculated. It was assumed from qualitative analyses that the radioactivity of zircon crystals was only due to the presence of thoria. Traces of niobium and/or tantalum were also detected in the zircon. The percentage of thoria was found to be 1.10.

### 72. Basement Topography of the Indo-Pakistan Plains.

K. C. CHANDIOK, Delhi.

Interesting results regarding the shape of granitic basement below the alluvial deposits of North India and Pakistan have been obtained from deductions made from the available data on the magnetic declination anomalies, which should open out new areas for oil exploration in India and Pakistan.

Below the plains in Sindh and Rajputana occur three ridges trending north separated by a trough and a basin.

Four series of ridges trending N.-S. to E.N.E.-W.S.W. on an easterly sloping basement may be recognised to exist below the Punjab Plains. In Uttar Pradesh a deep basin is recognised to exist below the Gangetic alluvium.

There also probably exist underground northerly extensions of Aravallis, Bundelkhand granite and the Kaimur Hills, below the Gangetic Plains.

A continuous ridge probably hidden below the alluvial deposits in Bengal connects the Archaean mainland to the Assam hills.

A topographic high occurs under the deltaic deposits in Surajganj-Jessore.

The Assam Hills are continued north-eastward below the Brahmaputra plains of Assam.

The author believes that there are enough reasons to predict the occurrence of oil in the Gujrat-Kathiawar areas near 72.1°E, 23.8°N and 71.1°E, 24.2°N. The underground ridge joining the archaean mainland with the Assam hills and the ridge at 71.8°E, 28° to 29°N in Rajputana should also form suitable traps for oil.

### 73. The Intermittent Uplift of the Himalayas during the Recent Period.

H. L. CHHIBBER, Banaras.

The author in this paper gives evidences to prove the intermittent uplift of the Himalays during the recent period. These evidences have been adduced by a study of several River Terraces of the Yamuna (Jumna) and some of its tributaries near Kalsi and Chuharpur in the Doon Valley of the Himalayas. The author is of opinion that even the Ganga (Ganges) near Banaras which has carved out a deep valley with cliffs about 100 ft. in height in places, is cutting its own flood plain and its meanders here are undoubtedly incised. The valleys of the Ganga and the Yamuna are regarded as multicyclic in character.

### 74. The Landforms and Radial Drainage of Mount Parasnath (Hazaribagh, Bihar).

H. L. CHHIBBER, Banaras.

The massif of Mount Parasnath, 4,550 ft. in elevation, forms a conspicuous land mark in the region and has an oval shape. The geological formations of the area comprise various types of eclogites (including hornblende-eclogite and glaucophane-eclogite), gabbro, diorite, hornblendite and granite gneiss. Garnet is a common constituent of these rocks.

Contamination of the previous rocks, mostly quartzites, by the invading and differentiating magma have produced some interesting hybrids.

The landforms of Mount Parasnath present a classical example of the radiating drainage descending from a massif. S. C. Bose (Cal. Geog. Rev., Vol. 7, 1945, p. 111) considers Parasnath to be a true mountain of circum-denudation, but the present author regards it a true laccolite of intrusive igneous rocks. The various landforms, like plateaux, ridges, spurs and valleys, have been described in detail, based on the field and laboratory study of the region.

### 75. On the Physical History of the Damodar Delta.

SIVAPRASAD DAS GUPTA, Calcutta.

In this paper light has been thrown on the existence of a delta of the Damodar River before the deposition of the Bhagirathi or Ganges Delta in its present form.

The study of the disposition of the deserted channels of the Damodar in the eastern part of Burdwan district, reveals that there was a time when the Damodar had a delta of its own. The deserted channels lie in the fashion of the deltaic distributaries bifurcating from an apex of a delta. The Damodar debouched from the west into the Bay of Bengal which extended like a narrow gulf northward in the past. The Bhagirathi flew down into the bay from the north through its delta which was smaller in size than the present one. Since greater quantity of detritus was deposited by the Bhagirathi than the Damodar, the delta of the Bhagirathi increased in area at a faster rate than the Damodar Delta. Ultimately the Bhagirathi alluvium was laid upon the marginal parts of the Damodar Delta and thereby the Damodar became merely a tributary of the Bhagirathi. Evidence has been drawn from the existence of Damodar alluvium and gravels underlying the alluvial soils of the Bhagirathi in the eastern part of the district of Burdwan. Light has also been thrown upon the probable cause of the southward deflection of the Damodar and eastward deflection of the main flow of the Ganges in the 16th. century.

### 76. Some aspects of the Political Geography of India.

PRADYUMNA P. KARAN, Patna.

The paper attempts to examine briefly some of the elements of India's Political Geography, which exert significant influence on her political strength and prestige in world affairs.

Having a large size, advantageous location, an agriculturally productive climate, usable landforms, diversified natural resources and fair industrial capacity, she is well endowed with the essentials of political geography and possesses a sound geographic foundation for a strong political power. Geographically well situated with respect to the large trade area of southern Asia and East Africa, undoubtedly, she is destined to be the dominant nation in her part of the world.

Although geographic factors point to India's dominance in Asia and to her taking place among the major world powers, but she has, like all other countries, some geopolitical problems. The extent to which these problems are solved will determine her ability to develop and maintain its

**status as an Asian world Power. At least four geopolitical problems can be discerned: (i) achievement of military security, (ii) development of national unty and political stability, (iii) augmentation of agricultural and industrial capacity, (iv) and adjustment to international responsibility.**

### 77. A plea for the study of Medical Geography of India.

PRADYUMNA P. KARAN, Patna.

Throughout the world the maximum utilisation of the man power—human labour—is intimately linked to human health and energy. This is more so in India, and here the study of the various environmental factors bearing on human health is imperative. India has a poor standard of health and several thousands die every year from cholera, small pox, plague, various forms of fever and malaria. The geographical factors which influence the occurrence of diseases and epidemics are: factors of physical geography, such as topography, climate etc; factors of human geography such as density of population, standard of living, housing conditions etc; and factors of biogeography such as flora, fauna and associated parasites etc. The correlation of the diseases and geographical factors would be helpful in the solution of the health problems of the nation. The study of the medical geography of India, however, presents difficulties chiefly because of the lack of reliable medical data of epidemiological significance. Nevertheless, the various published health reports provide useful literature for research.

### 78. Trap-Lands of Deccan (a study in Cultural Landscape).

K. N. MUKHERJI, Calcutta.

The Deccan-trap area bears in all respects a uniform environmental condition and so the cultural landscape of the region is absolutely contrastive to that of the adjoining areas. The author differs in opinion in regard to the actual extent of the typical trap areas and has contradicted some of the well established Geographical assertions regarding the formation of regur soil and its crop association. The denudation chronology in the erosion cycle of the region has also been brought out. The land holdings, the house types and the settlement patterns in the perspection of trap environment, are of special consideration in this paper.

### 79. Industries of the Patna District (Bihar).

K. SINHA, Gaya.

**The resources of the district in raw materials required for the development of several types of industries are ample. The sugarcane in the western part of the district provides raw material for sugar industry at Bihta. Skilled labour is responsible for specialised type of 'durry' and Carpet industry near Biharshariff. The navigable waterway in the north, roads and railways have facilitated the flow of trade and provide market for the industrial produce of the district.**

The main industrial sector of the district is along the bank of the Ganga. This zone is the seat of varied types of industries as cotton, sugar, rice, flour and oil mills, leather and shoe factories, soap factories, railway workshops, boat building, engineering including electrical workshops, iron foundry, safe and steel industry, bicycle factory.

Another industrial zone is near Mokamah. One modern shoe-making industry is located here and two railway workshops are situated at Mokamaghat.

Industrially Masaurhi is growing into prominence and one oil mill is located there.

The heavy concentration of industries at Patna has resulted in high rents, and dearth of good sites and ultimately in dispersal of industries. The industries are shifting where raw materials and easy transport are available.

### 80. Land Utilisation in Madhya Pradesh.

K. N. VARMA, Nagpur.

Land use in M. P. is handicapped by its topographical features and conservative outlook of its people. The variety of landscape consists of three regions of uplands with two intervening lowlands (Vindhyas, Narbada Valley, Satpura plateaus, Maratha plain and the Chhattisgarh plain). The total land utilized is 27,080 thousand acres of which only 89 p.c. comprises net sown areas. Practically there has been no change in Rabi and Kharif acreage during the past 40 years and no change in the area under permanent railroads and highways. Index of cultivation in M. P. is only 42.9 p.c. The highest gross cropped area noted was only in 1929-30. Cultivated land available per capita is only .6 acres for the whole M. P. and .5 acres for rural population. Poverty and hard life is a chronic problem. Important crops are rice, juar, cotton and wheat and there are three important crop zones—rice, wheat and cotton. Irrigation is done by tanks, canals and wells. Though a surplus state, it is backward in intensive cultivation and extensive land use.

# *40th INDIAN SCIENCE CONGRESS, LUCKNOW, 1953*

## SECTION OF ANTHROPOLOGY AND ARCHAEOLOGY

*President*:—Pandit Madho Sarup Vats, Hon. F.R.A.S.

### 1. Comparative study of the somatic characters of the Uralis & the Paliyans.

B. K. CHATTERJEE and G. D. KUMAR, Calcutta.

Somatometric measurements and observations were made on 115 adult male Uralis and 47 Paliyans. The statistical analysis of the comparative mean values of the data revealed that the Uralis and the Paliyans are short statured, having dolichocephalic heads associated with mesorrhine nose. Among a certain percentage of the people the leptorrhine nose was also evident. The presence of brachycephalic heads was also observed among the Paliyans. The skin colour varied, but majority of them was observed having deep, chocolate brown colour Nos. 25-26, after von Luschan's skin colour chart. The character of the chin is either neutral or negative among the highest number of the people. Darwin's point was obsrved among certain percentage of the people. The presence of frizzly hair was observed among certain member of the Uralis.

### 2. A short note on Different Body Proportions of the Onges of Little Andaman.

B. K. CHATTERJEE, Calcutta.

The inhabitants of Little Andaman are known as Onges. They are the sole inhabitants of the island and racially belong to the Negrito stock.

Data of both males and females on the different body measurements, viz. Stature, sitting height, Bi-acromial breadth, length of forearm and Upperarm etc., were taken during the winter of 1952. The statistical analysis of the mean values are as follows—

| | *Male*<br>Mean value | *Female*<br>Mean value |
|---|---|---|
| Stature .. .. | 1477.85 | 1389.47 |
| Sitting height .. .. | 756.03 | 699.43 |
| Bi-acromial breadth .. | 332.31 | 312.65 |

They are short statured. The character of the hair is woolly, having intermediate spaces. Majority of them were observed to possess alveolar prognathism and the presence of Steatopygia was noticed among the females.

### 3. Customs, habits and beliefs of the Onges of the Little Andaman.

B. K. CHATTERJEE, Calcutta.

The marriage, birth and funeral customs of the Onges are dealt with and in addition, their mode of living and belief in spirit. Their dance and personal decorations were also studied.

### 4. Social Organization of the Kanikkars of Travancore.

BHABANANDA MUKHERJEE, Calcutta.

The Kanikkars of South Travancore are matrilineal. The chief characteristic of their social structure is the division of the society into two groups which are exogamous in nature and function. The study of 318 marital relations uphold the principle of dual exogamy. Besides, the kinship terminology—the result of the classificatory system of kinship, supports the dual principle. The study of kinship terminology reveals identities of several terms probably suggesting the marriage customs and types of marriages namely cross-cousin, levirate and sororate. The kinship usages and taboo in the form of mother-in-law avoidance emphasize the dominance of kins on the mother's side in social relations. The modes of inheritance and succession are matrilineal in some places where shifting cultivation with hoe is still practised but changes have occurred in other places where plough cultivation has been taken up in right earnest.

### 5. A Bondo Child's Cremation.

ASUTOSH BHATTACHARYYA, Calcutta.

The practice of cremating a child is not generally met with either among the aboriginals or among the Hindus of India. The general practice prevalent among all sections of Indians—Hindus, semi-Hindus and aboriginals, is to bury the body of a child than to cremate it. But the Bondos, who live above the hills in the Koraput District of Orissa, do not bury children even one day old—they practice cremation instead. However, a token burial is also given to the body before it is cremated. Therefore it is supposed that actual burial in such cases has been replaced by cremation. It seems to be a rare example of burial being replaced by cremation among the Indian aboriginals though the opposite practice is a more common feature. The author of the paper narrates his own personal experiences which he had in assisting in a 10 days' old child's cremation in Bondo hills.

### 6. Dravidian kinship terminology and marriage customs.

IRAWATI KARVE, Poona.

Certain peculiarities of the Dravidian kinship terms are discussed and correlated to certain types of preferential mating and certain types of marriage taboos found in the Dravidian speaking region. A new theory for the understanding of the Dravidian kinship system is proposed in this paper. The northern classification is based on the following distinction between generatinons:—Grandparents—Parents—ego—children—grandchildren etc. The Dravidian classification on the other hand is based on a distinction between:—Persons older than ego—ego—persons younger than ego.

### 7. A short note on Magico-religious ceremonies and Scare-devils among the Nicobarese of Nicobar Islands.

B. K. CHATTERJEE, Calcutta.

The Nicobarese sacrifice pigs or chickens before wooden effigies of different animate and inanimate objects, particularly before the eagles. Painted wooden boards depicting various human and animal figures, viz., fishes, snakes, turtles, rainbow, canoe, are propitiated to drive out the evil spirits.

### 8. A Note on Rain-Making Rites.

S. R. DAS, Delhi.

Many are the folk rites observed in different parts of India to cause rain to pour down in times of drought. This paper refers to some such rain-making rites with particular reference to a folk rite of Bengal, which consists of digging out a miniature tank, planting of plants and branches in the centre of that tank, pouring water into the tank and on the planted plants and finally making an offering to the frog. It has been observed that the performer of this particular rite of Bengal by going through these rituals desires to have rain to enliven plants and to fill up the tank. Again, that the offering made to the frog which is the custodian of rain, has a certain association with rain-making cannot altogether be ruled out. In fact this rite is a sympathetic magical performance for rain-making.

### 9. Stone age Industries around Giddalur (Kurnool District).

K. V. SOUNDARA RAJAN, New Delhi.

A decisive impetus was given to South Indian Prehistory in 1930 by the great savant of Prehistory, Prof: M. C. Burkitt when together with Mr. L. A. Cammiade, the noted civilian archaologist, a series of four industries were discovered (*Antiquity* 1930) along the Kistna basin which stratigraphically and typologically pointed to a probable correlation in a series of pluvials and interpluvials with the Northern Himalayan glacial and inter glacial cycles, as demonstrated by De Terra and Paterson. One among the sites involved in this southern palaeolithic series, was Giddalur near Nandikanama pass in Kurnool District. Later in 1949 under the auspices of the Department of Archaeology, Government of India, an expedition, occasioned by the presence in India of Dr. F. E. Zeuner, Geochronologist of the London University was made to the various South Indian Stone Age sites and stone artefacts and other field data were collected.

The present paper deals with the results of a preliminary study of the palaeolithic and microlithic collections made from sites in and around Giddalur and constitutes a continuation of Mr. Burkitt's previous investigations.

The typological examination of the tools has revealed that while at Giddalur I site the essential elements of Series I and II of Burkitt and Cammiade including rostrocarinates, 'Victoria West' types, Vaal' technique cleavers and flake made tools are available and Series III and IV are practically absent, in the Giddalur II site series III and IV are clearly represented containing besides others, levallois flakes, scrapers and bladish flakes of a diminitive aspect in greenish quartzite and microliths mainly on dyke quartz of the milky variety and rarely on lydianite and red jasper—with a minor manifestation also of Series II and I. The collections from two other neighbouring sites, Kanchupalli and Talapalle are essentially of series I, even though the latter does reveal certain Middle Palaeolithic characteristics also. The palaeolithic tool types in the main correspond largely to similar tool types from South Africa.

The microliths would appear to be analogous variously with the Wilton and Still Bay of the African series and some of the main types are parallel sided and backed blades, almond shaped and tanged points, burinate tools and a few scrapers. Those comprise the Series IV industry.

The stratigraphy of the low and badly preserved cliff sections of the sites at Giddalur I and Talapalle shows two aggradational phases with a period of comparatively drier intervening phase. On the basis of 'etat physique', the tools of Series III and IV are the most fresh looking ones in the collection.

### 10. Influence of raw material on the lower Palæolithic Industry of the Malaprabha Basin (Bombay State).

R. V. JOSHI, Dharwar.

"The palaeoliths collected from Madras and the Godavari and Malaprabha rivers show the preponderance of tools worked on flakes. On the other hand the specimens from Gujarat and the Narbada river contain a fairly high proportion of pebble-core-implements. On typological and technical basis both belong to the same Chello-Acheulean culture. In the surveys carried out by the author in the basins of the Malaprabha, Godavari, and Mahi rivers it is observed that the type of raw material that is available at these places has greatly influenced the working of the palaeolithic tools. The absence of suitable pebbles in the Malaprabha and Godavari rivers, and in Madras area compelled the palaeolithic man to use large flakes, which were readily obtainable from the outcrops of rocks or from the talus material, while in big rivers like the Sabarmati, Mahi, and Narbada, the pebbles were favoured as these were large enough for the preparation of implements. The occurrence of flake tools or the pebble-tools (core-tools), in a certain region, therefore, is not necessarily a criterion of different stages of culture, but only suggests the wisdom of the palaeolithic man in using whatever raw material was available nearabout his settlements.

### 11. Further Copper Hoards from the Gangetic Basin.

B. B. LAL, Calcutta.

Copper Hoards comprising antennae swords, harpoons, anthropomorphic figures and bar-celts etc., have been discovered from time to time in Northern India. According to Prof. Hiene Geldern they are the 'archaeological traces of the Vedic Aryans', while Prof. Piggott thinks that they may be associated with Harappan refugees moving eastwards.

Besides recording 35 unpublished implements from sites in Vindhya Pradesh, Uttar Pradesh and Orissa, the author enquires if the implements could possibly belong to the non-Aryan tribes whom Vedic Aryans encountered on reaching Northern India. Reasons adduced are:—

1. Trial excavations at the Copper Hoard sites of Bisauli and Rajpur Parsu have yielded a coarse. ochre-washed, rolled ware which may have been associated with the implements. More or less similar pottery has been recovered at Hastinapur *below* the Painted Grey Ware which is now known to have been associated with the Aryans round about 1000 B.C. Hence the possibility of a pre- and non-Aryan character of the implements.
2. The copper bar-celts seem to have originated from similar stone-celts discovered in southern Bihar, western West Bengal, northern Orissa etc.
3. The copper harpoons are echoed in certain cave-paintings of the Kaimur ranges.

Numbers 2 and 3 point to a region now inhabited chiefly by the Proto-Australoid tribes. Can it then be said that their ancestors were responsible for the Copper implements? Further field-work alone can answer the question.

### 12. Problems at Amreli.

S. R. RAO, Baroda.

Importance of the site at Amreli may be appreciated by its situation near other early sites like Rangpur and Junagadh. The site had been excavated earlier by the late Dr. Hiranand Sastri sometime before 1945. Further work, however, was resumed in 1952 by the Department. This supplementary excavation has revealed *inter alia* post cremation burials in two levels.

i. Pit circles (later),

and

ii. urn burials (earlier).

The former are associated with a red polished pottery and iron objects whereas iron is conspicuous by its absence in the latter in association of which microliths have been found.

The red polished ware which has a fairly wide distribution in Kathiawad and Gujerat was found in Kashatrapa levels. Below this in one trench a few sherds of the northern black polished ware were found. This gives a chronological datum to the sequence above and below.

The notable problems outlined in the paper are:

i. Is the pit-circle-burial a later survival of Brahmagiri pit circles which are megalithic?

ii. Does Urn-burial represent a different culture?

iii. Can the red polished ware, being securely dated, serve as a datum for other sites in western India?

iv. The microlithic culture and the Rangpur ware in the light of Amreli Excavation.

### 13. Prehistoric Bastar.

V. D. KRISHNASWAMI, Visakhapatnam.

The District of Baster, originally a feudatory State in the Chhatisgarh Division and now merged with Madhya Pradesh after the Indian Independence, has been recently taken over by the Archaeological Department of the Indian Union for investigating its archaeological wealth. This region is still the *terra incognita* to the Archaeologist and the cul-de-sac of the Anthropologist. The aboriginal Gond tribes of Baster, mostly naked, are still in the Stone Age and speak the Mon-Khmer group of languages, though detribalisation is fast going on, Hinduizing the folk. In a decade the indigenous prehistoric cultures would be wiped out by culture-contact coming from all sides of Baster which cannot be stemmed.

In March this year, the author discovered at Chitrakot waterfalls a microlithic site, the first Stone Age evidence in Baster. To the jungle tribes of the locality, these microliths have no meaning. The aboriginal tribes of Bastar still erect memorial megalithic monuments to the dead, a feature which makes the prehistory of the region very interesting. The present evidence shows that this feature has come from the Far East in the neolithic times with the introduction of the Burmese shouldered celt along with menhirs by the great Austronesian migration. Worman has quite recently made us think afresh that our Neolithic problem in the prehistory of India may after all have to be solved from a Far Eastern origin —most probably from Indo-China. The presence of Burmese celt near Kunavaram on the Godavari prompts one to think similar artefacts can be expected in ancient Maria camps in Baster in the Abujhmar area because the Indravati must have served as a highway for the movement of the neolithic people from the East.

The presence of Danyakal (a dolmenoid structure) among the Maria Gonds of South Baster in a predominantly menhir region makes one think whether this may not have been introduced by the Iron Age cultural wave coming from the west. The megaliths of this latter culture (Stone Circles, Dolmens and cists) prolific all over South India are all actual burial monuments. A branch of this western Iron Age megalithic culture seems to have passed round Baster farther eastward to Chota Nagpur and Assam. This is strongly supported by the presence of stone circles and dolmens in Nagpur, Chanda and Drug Districts. The only place where we can hope to get a clue to the prehistory of Bastar, especially the neolithic phase, is the Abujhmar region occupied by the Marias. They are the only people least affected by culture-contacts who still remain in the real Stone Age environment such as axe-cultivation and erecting funerary memorial menhirs.

The river valley of the Indravati and the Kolab-Sabari of Bastar, both affluents of the Godavari, have to be surveyed carefully for the Old Stone Age sites inasmuch as the right kind of quartzite occurs in plenty *in situ* for fabrication of artefacts and many of them belonging to the Madras Industry have been found since 1865 along the Godavari and its other affluents not far from the confluence of these two tributaries. The limestone caves near Jagdalpur will also yield palaeontological data for dating the Stone Age as the fauna of Baster jungle are much varied and prolific.

### 14. From History to Prehistory in Western India.

H. D. SANKALIA, Poona.

"The writer reviews briefly the most important results of the explorations and excavations conducted by the Deccan College Research Institute, Poona at Kolhapur, Nandur-Madhmeshwar, Nasik, Gangapur and Jorwe from 1943-1951, and points how these help in giving a cultural sequence backwards from the Andhra-Satavahana-Roman times back to the Lower Palaeolithic, through the intermediary Copper-Bronze Ages and the Mesolithic periods. This sequence is true at present only of the Deccan (Maharashtra)."

# *40th INDIAN SCIENCE CONGRESS, LUCKNOW, 1953*

## SECTION OF MEDICAL AND VETERINARY SCIENCES

*President*:—Dr. S. DATTA, D.Sc., M.R.C.V.S., D.T.V.M., F.N.I.

## BACTERIOLOGY.

### 1. Virulence of Bovine Tubercle Bacilli isolated from animals in India.

L. SAHAI and M. R. DHANDA, Mukteswar-Kumaun.

A comparative study of 27 Indian strains and 7 English strains of bovine tubercle bacilli revealed that there is no appreciable difference in virulence of the strains to small laboratory animals as summarized below:—

The average duration of life of rabbits inoculated intravenously with 0.1, 0.01 and 0.0001 mgm. of bovine tubercle bacilli was found to be 31, 34 and 85 days respectively in the case of Indian strains and 24, 31.5 and 76.42 days respectively in the case of English strains.

1.0 and 0.1 mgm. of Indian strains given subcutaneously, killed guinea pigs in an average of 48.8 and 53.3 days respectively. A dose of 0.0001 mgm. of Indian tubercle bacilli killed guinea pigs in 50 to 119 days (average 85 days), while English strains in the same dosage killed guinea pigs in 53 to 127 days (average 83.1 days).

### 2. Susceptibility of the Indian buffalo to the Bovine Tubercle Bacillus.

L. SAHAI and M. R. DHANDA, Mukteswar-Kumaun.

Susceptibility of Murrah buffalo calves below 4 months in age to six strains of bovine tubercle bacilli was tested. Three week old cultures grown on plain agar were used in 50 mgm. doses administered subcutaneously. It was observed that fully virulent strains killed the calves in 18 to 61 days (average 35.3 days) producing generalised tuberculosis; strains with lesser virulence killed only a certain number (5 out of 8) and in the rest a retrogressive or a chronic progressive type of tuberculosis was produced; attenuated strains produced only slight retrogressive tuberculosis. The comparative virulence tests of the strains were carried out in rabbits.

The susceptibility of Murrah buffalo calves to bovine tubercle bacilli is of the same order as of the English cow calves.

### 3. Corynebacterium Ovis infection in goats.

M. R. DHANDA and M. M. SINGH, Mukteswar-Kumaun.

An outbreak of parotid abcesses caused by *Corynebacterium ovis* in a flock of experimental goats maintained at the Indian Veterinary Research Institute is reported.

### 4. Corynebacterium Pyogenes Mastitis following cow pox.

R. N. MOHAN, Mathura, U.P.

Over 100 cows and buffaloes on organised farms were found affected with suppurating mastitis during outbreaks of cow pox. Many suckling calves were affected with periodontal suppuration.

*C. pyogenes* was recovered in pure cultures from the purulent udder secretion of several animals.

Similar cases of suppurating mastitis, generally due to *C. pyogenes*, have been encountered in lactating goats affected with pox lesions on the teats.

### 5. Streptococcus Agalactiæ from the Lung Abscesses of a young dairy calf.

M. R. DHANDA and M. M. SINGH, Mukteswar-Kumaun.

A case of lung abcesses in a young dairy calf is recorded from which *Streptococcus agalactiae,* a frequent cause of contagious mastitis in cattle, was isolated. The cultural characters and biochemical and serological reactions are described and the significance of the occurrence of this organism in the lung lesions has been discussed in detail.

### 6. Hæmolytic Streptococci infection in pups.

L. SAHAI and P. R. NILAKANTAN, Mukteswar-Kumaun.

Ten out of fourteen bitches and one out of four dogs in the kennels at Mukteswar were found to be carriers of *Haemolytic streptococci* in their vaginae and sheaths. Periodical examination during a period of three years did not reveal any changes in the carrier state.

Pups born to infected mothers died within a few days after birth. Weaning of pups soon after birth did not affect mortality rate. The mortality was more in winter months than in summer.

*Haemolytic streptococci* was isolated from the heart blood and other internal organs of the dead pups and also from the vaginae or sheath of those pups born to infected bitches, which survived for a period of two months after birth.

Twenty-four strains of *Streptococci* were studied in detail. All the strains produced a final pH of 4.6 to 4.9 in dextrose broth, grew in 10% bile, reduced 1:5000 dilution of methylene blue in milk but did not hydrolyse sodium hippurate. Six strains neither fermented trehalose nor sorbitol while the rest fermented only trehalose but not sorbitol. Nine strains conformed to group 'G' and the rest to group 'C' of Lancefield.

### 7. Studies on Salmonella abortus equi Vaccine.

M. R. DHANDA, J. M. LALL and M. SINGH, Muktsswar-Kumaun.

I. An improved formalin detoxicated and alum-treated *Salmonclla abortus equi* vaccine was evolved to replace the heat-killed vaccine, which at times produces toxaemic symptoms. The modified vaccine is absolutely safe for the ponies and comparative tests in mice revealed the superiority of the former.

II. With a view to evolve a suitable test in laboratory animals for assessing the protective properties of equine abortion vaccine, pathogenicity of *Salmonella abortus equi* in mice was studied and its M.L.D. determined.

### 8. Isolation of Salmonella bovis morbificans from an outbreak amongst chicks.

P. G. PANDE and P. R. NILAKANTAN, Mukteswar-Kumaun.

The cause of a severe outbreak amongst chicks resulting in 50 to 60 per cent mortality in one Military poultry farm was investigated. Mostly chicks upto four weeks of age were affected. The main symptoms were dullness and diarrhoea ending in death in 3 to 7 days. Occasionally, paralysis of the legs was noticed.

Motile *Salmonella* from the heart blood and other internal organs was isolated from dead or dying chicks. The strains isolated turned litmus milk alkaline, did not produce indole, fermented with the production of acid and gas dextrose, mannite, dulcite sorbite, inosite, maltose, xylose, trehalose and dextrin but did not ferment lactose, sucrose, rhamnose and arabinose. The organisms were found to be pathogenic to one month-old chicks and adults birds on artificial infection.

Two of the strains typed as *Salmonella bovis morbificans* with the following antigenic structure:—

O = VI, VIII; H=r ↔ 1, 5 at Public Health Laboratories, London.

### 9. "Antagonistic effect of Cysteine Hydro-Chloride on the action of Penicillin on Pasteurella septica".

N. B. DAS and P. R. NILAKANTAN, Mukteswar-Kumaun.

0.5 units per ml. of penicillin was found to inhibit the growth in broth of a certain number of *Pasteurella septica.* Effect of penicillin could be antagonised by the incorporation in the medium of a M/50 solution of cysteine hydrochloride neutralised with sodium bi-carbonate. The antagonistic effect of cysteine hydrochloride was not altered appreciably by yeast nucleic acid.

Ascorbic acid, thioglycollic acid, sodium hyposulphite and methionine alone or in combination with yeast nucleic acid did not show any inhibitory effect on the action of penicillin when the test organism was *Pasteurella septica.*

### 10. Effect of Penicillin and Sulphonamides in Experimental Pasteurellosis.

P. R. NILAKANTAN, N. B. DAS and R. MUKHERJEE,
Mukteswar-Kumaun.

Successful treatment of rabbits experimentally infected with *Pasteurella septica* has been recorded. One thousand units of penicillin were administered subcutaneously once in 3 hours for the first 48 hours and once in 8 hours during the next 48 hours, the treatment being commenced 6 hours after infection. When 2000 units of penicillin per injection were administered cure was brought about within 48 hours. Penicillin has been found to be effective in the treatment of experimental Pasteurellosis in hill bulls when the treatment was commenced after the symptoms of the disease were observed and the bacteria were demonstrated in blood.

Rabbits, treated with penicillin after infection with *Pasteurella septica,* seemed to develop some resistence to reinfection depending on the dose of penicillin used for treatment.

*Pasteurella septica* did not develop any appreciable resistence to penicillin even after 50 serial subcultures in media containing penicillin.

Sulphamethazine did not prove to be of much value in the treatment of Pasteurellosis. Though penicillin and sulphonamides acted snergistically on *Pasteurella septica in vitro,* this was not appreciable *in vivo*; however, definite increase in survival time of rabbits treated with a minimal dose of penicillin and sulphamethazine was observed than in the untreated controls or those treated either with penicillin or sulphamethazine with same dose.

### 11. Pathogenicity of Pasteurella septica in mice.

M. S. DAS, Mukteswar-Kumaun.

It is observed that the response to experimental inoculation of *Pasteurella septica* in mice is definite and specific. The tests were carried out by using 24, 48 and 72-hours plain broth culture. Three different routes, e.g., intraperitoneal, subcutaneous and intramuscular, were tried. Inoculum used was 1 c.c. of $10^{-5}$ and $10^{-6}$ dilutions. Three mice were taken in each batch of different experiments.

Of 54 mice, thus inoculated, all died of pasteurellosis. The average "inoculation-death" periods in case of the 24 hour old culture were intraperitoneally—15 hours, subcutaneously—25 hours and intramuscularly—40 hours. With the 72 hour old cultures this average period was slightly higher.

The specificity of the reaction may encourage the use of mice in place of rabbits. Besides, it may encourage the use of mice in standardisation of vaccines and sera.

Post-mortem changes revealed darkening and enlargement of spleen. congestion of liver and mottling due to abnormal definition of lobules.

### 12. The effect on Virulence of a Strain of Pasteurella septica on passage through Albino rats.

M. S. DAS, Mukteswar-Kumaun.

Albino rats have been found to be extremely resistant to experimental infection with *P. septica*. It was, therefore, thought that serial passage of a bovine strain of the organism through rats may lower its virulence for bovines, thereby evolving a strain for the purpose of preparing a live vaccine.

Strain maintained on culture media often fails to establish itself in rats. Thus, continuous serial passage becomes difficult. However, using blood from an affected bull as the primary inoculum into rats then passaging it in rats, the organism could be kept circulating.

Thirty-one serial passages were made and the organism was tested for virulence in mice, rats and guinea pigs at every fifth passage or so. It was found to acquire an increased virulence for rats and guinea pigs but showed no change in its virulence for mice.

### 13. Some obserbations on resistance mechanism of normal and immune rats against Pasteurella septica.

M. S. DAS, Mukteswar-Kumaun.

Albino rats are extremely resistant to infection with *P. septica* and were considered suitable subjects for resistant experiments. Two batches of rats were taken, one having received injection of live cultures of *P. septica* three weeks previous to the commencement of the present experiment. These rats were taken as being immunized.

All the rats were inoculated with 1 c.c. of a $10^{-4}$ dilution of a 24 hour broth culture subcutaneously at the inguinal region. Groups of two rats were killed at different intervals. Smears were made from the local lesions, local lymphatic gland, heart blood, liver, spleen and bone marrow. Simultaneously cultures were made from these materials.

In the normal rats, large number of bipolar organisms were seen in smears from local lesions up to the 48th hour. Similar result was noticed culturally, there being no growth after the 48th hour. Heavy leucocytic infiltration started from the 12th hour. Most of them were polymorphs. Except in one rat, which died after 24 hours, no organism could be demonstrated in the heart blood or in any other organs or tissues besides the tissues at the site of inoculation.

No viable organisms were found in the local lymph gland suggesting that the lymphatic block was very efficient. No clumps of organisms could be seen signifying in vivi agglutination, although the possibility of the precence of a lytic factor could not be ruled out. It appears that the greater part of the defence mechanism involves an intracellular process. In immunized rats, the organisms seemed to die out quicker, there being no growth at the 18th hour and thereafter. Phagocytosis was less marked in this case. In any case, it was mainly effected by large monocytes. It is possible that due to preimmunization more of the lytic or such like agents were present in the tissues.

### 14. Susceptibility of Pasteurella septica in blood from Carcasses to the Vitro action of some Bacteria.

M. S. DAS, Mukteswar-Kumaun.

Antagonism of certain bacteria towards *P. septica* in vitro has been studied. Blood from a bull which died of experimental haemorrhagic septicaemia was collected in test tubes. Blood samples were inoculated with the organisms—*B. coli*, *Staph. aureus*, *B. subtilis* and *B. anthracis* and were kept at 37°C. Cultures were made from these tubes at intervals of 24 hours. Up to the 10th day, which is the maximum period tested for *P. septica* was found to be viable in the blood samples. It, therefore, appears that none of these organisms has any antagonistic action on the *P. septica* as tested under above mentioned conditions. The control tube of blood only yielded pure cultures of *P. septica* under similar conditions.

### 15. Some observations on the Laboratory diagnosis of Anthrax.

M. S. DAS, Mukteswar-Kumaun.

Carcasses of guinea pigs died after experimental anthrax were kept at room temperature (17°C. to 25°C.) and 32°C. Microscopic, cultural and biological tests were carried out with materials from the subcutaneous tissues and from the spleen at various intervals to find out the maximum period up to which laboratory diagnosis can be considered helpful. The findings also throw some light on the comparative value of the three methods in relation to the time after death.

Clear capsules and intact soma were visible up to about 10 hours when kept at 32°C. and up to 24 hours when kept at room temperature. After this period the organisms start to degenerate. Degeneration at 32°C. seems to be complete by 24 hours and at room temperature it takes about 60 hours. In this connection indications are that degeneration of the capsule starts prior to that of the soma.

With the carcasses kept at 32°C. no growth of anthrax bacilli was seen from spleen material taken after 24 hours. Subcutaneous, tissues showed viability at the 48th hour. Mice inoculated with 15 hour spleen material died but they survived 24 hour material. The mice injected with 36 hour subcutaneous material died but not with 48 hour material.

When carcasses were kept at room temperature, anthrax bacilli were viable in spleen material taken after 80 hours but not if taken after 108 hours. In subcutaneous material organisms were viable up to 148 hours, the maximum period tested for. Biological tests revealed that mice receiving 80 hour spleen material died but survived 108 hour spleen. Mice injected with 148 hours subcutaneous material died.

Superficial tissues contain viable anthrax bacilli for a much longer period than the deeper tissues although at no stage presence of any spores could be demonstrated in the subcutaneous tissues. It was observed that cultural test was more reliable than the biological test.

### 16. Studies on Mallein.

M. R. DHANDA, J. M. LALL and P. C. GANGULEE,
Mukteswar-Kumaun.

I. Non-specific reactions in the mallein test may be encountered when the product is prepared from media containing animal proteins. To eliminate these, synthetic medium containing l-asparagine had been employed for the manufacture of mallein, but this considerably increased the cost of production since asparagine is a very costly chemical. With a view to reduce the cost of production of synthetic mallein the possibility of replacing asparagine with cheaper chemicals, *viz.*, ammonium malate and ammonium succinate, was investigated.

Growth of *Pf. mallei* in ammonium malate medium was quicker and more luxuriant than that in media containing ammonium succinate and l-asparagine. Different brews of synthetic mallein were prepared using the above three chemicals and were tested on artificially infected glandered ponies. Intra-dermo-palpebral test showed that mallein prepared from ammonium malate evinced better reactions than ammonium succinate mallein and asparagine mallein.

II. Preliminary experiments were performed to explore practicability of producing P.P.D. (Purified Protein Derivative) mallein from culture filtrate by using half-saturated ammonium sulphate as a precipitating agent. The sedimented sludge was washed with 0.3% KH2 PO4, centrifuged and obtained as a dry mass either by treating with acetone and aether or by blowing air. The dried mass was redissolved in normal saline solution in different strengths. Artificially infected glandered ponies as well as healthy ponies were tested with the product and the reactions compared with synthetic mallein. Ammonium sulphate precipitated mallein appeared to be more specific.

### 17. Studies on the Chemotherapy of Bacterial Infections, Part IIII; Pharmacology of Formaldehyde-Sulphonamide Derivatives.

A. N. BOSE, SRIPATI BOSE and S. GHOSH, Calcutta.

In continuation of previous studies on formaldehyde derivatives of sulphonamides, the acute and chronic toxicity, concentration in blood and tissues and urinary excretion in human being of Formo-Sulpha-Cetamide (S.A.F.) Formo-Sulphathiozole (S.T.F.) and Formo-Sulfabenzamide (S.B.F.) have been studied. Toxicologically, S.T.F. is a highly inert substance. The scanty absorption of the drug in the organs, and the negligible concentration in blood suggest its low toxicity to be associated with its insolubility and low absorbability. The corresponding $LD_{50}$ of both S.A.F. and S.B.F. shows that the substitution of the para-hydroxy methyl group into the respective parent compounds has slightly increased their toxicity. But both S.A.F. and S.B.F. are rapidly absorbed and maintains a high concentration, in blood and tissues. In the brain both maintain a steady concentration, indicating their rapid passage through the blood-brain barrier. The urinary excretion of S.A.F. is rapid in human beings, more than 90% of the drug being recovered in 4 days.

### 18. "On the Economics of Papain Digest Liver Broth Media for Cultivation of Clostridium chauvoei".

N. S. VERMA, K. GOVINDA RAU and J. L. GOVIL, Lucknow.

*Clostridium chauvoei* has been found to give a diffuse growth in a medium having papain digest liver broth as substrate. Digestion of liver tissue was carried out with papain. Processed digests of liver gave equally good results when the digests were used as such or half diluted with distilled water for the cultivation of *Clostridium chauvoei.* No peptone is needed for incorporation into the medium. The final medium containing commercial cane sugar is comparatively cheaper than other media ordinarily employed for cultivation of *Clostridium chauvoei* and gives as good a growth of the organism as liver infusion broth with glucose. The possibility of using this medium for large scale manufacture of Black-Quarter Vaccine is under study.

### 19. On suitability of Papain in the preparation of Culture-Media.

N. S. DATT, P. C. GANGULEE and J. M. LALL, Mukteswar-Kumaun.

With a view to reduce the cost of production of the various biological products issued from this Institute, a study was undertaken during 1950 to investigate the possibility of preparation of bacterial vaccines from media prepared by using papain to digest native proteins so as to eliminate the addition of peptone which on account of import difficulty had become extremely costly.

It was observed that *B. coli, B. anthracis* and *Past. septica* gave more luxuriant growth on papain-broth than on peptone-broth.

### 20. Use of JSB Stain in Bacteriological work.

M. S. DAS, Mukteswar-Kumaun.

This staining technique has been used extensively in haematological and protozoological work as a substitute for the Romanowsky stains, and has been found efficient for staining *Pasteurella septica.* It has also been found to be useful in *P. pestis.*

The method is easy, quick and gives a very satisfactory result. When stained by this method, the spirochaetes show up very prominently.

Besides, the methylene-blue component can be successfully utilized for the staining of anthrax blood smears. The soma of the organisms, in this case, stain deep blue and the capsules take up a bright pink purple colour having a well defined capsular membrane.

### 21. A differential Media for the isolation of Pasteurella septica.

M. S. DAS, Mukteswar-Kumaun.

It is observed that cobalt chloride at a certain strength is capable of inhibiting proteus at the same time allowing the growth of *P. septica*. Further, it has been observed that this organism is able to grow on a medium containing crystal violet which strongly inhibits a good number of the common contaminants. With these two substances in the ordinary agar medium it is possible to evolve an efficient medium to isolate *P. septica* with considerable ease.

### 22. Skim milk as a clarifier for Commercial Agar-Agar.

P. C. GANGULEE, J. M. LALL and M. S. DAS, Mukteswar-Kumaun.

Commercial agar requires clarification with white of egg before incorporating it in culture media. Experiments were carried out to find out suitability of milk as an alternative clarifying agent. It was observed that whole milk added at 5 c.c. per 1000 c.c. of molten agar clarified and produced more clear agar by removing pigments as compared to egg-clarified agar. Use of skim milk (unsterilized as well as steam-sterilized) prevented slipping of the medium from the surface of tubes, which occurs in the case of whole milk due to the fat present therein.

*Staph. aureus, Staph. albus, B. subtilis, B. anthracis, Past. septica, B. coli, Listerella monocytogenes, Ps. aeruginosa, Salm. abortus equi, Strept. faecalis*, were sown on nutrient agar slants prepared by using (a) unsterilized skim milk and (b) sterilized skim milk and satisfactory growth was obtained in each case. The amount of growth in these media compared favourably with that obtained on nutrient agar slants prepared by using egg albumin as a clarifying agent.

### 23. "An easy method of collecting serum samples from the ear vein of Bovines".

H. N. RAY and R. BHASKARAN, Mukteswar-Kumaun.

A simple method of obtaining serum samples in capillary tubes for conducting the Stilbamidine test is described.

*Advantages.*

1. This method is very cheap since it needs only capillary tubes, which can be made available easily.
2. Large number of samples can be collected in a short time. The authors could collect samples from hundred animals in one hour.

### 24. A new automatic syringe.

K. RAMA RAO.

The appliance has various advantages over the other syringes in use for mass inoculations of livestock. It is easy to handle. With aseptic precautions injection is done in a split second by gently pressing the

### 24A. Further trial of Aureomycin in the treatment of Cholera.

S. C. SEAL, M. M. GHOSH and S. C. GHOSAL, Calcutta.

Fifty cases were treated with aureomycin capsules, 35 with sulphaguanidine and another group of 35 cases with saline; last two groups served as controls. No difference in the fatality rate was noted in these groups which was about 14 per cent. The average dose of aureomycin used was 23 capsules, each containing 250 mg. but smaller dose of 12 to 20 capsules (3 to 5 gm.) according to the stage of the disease may be adequate. The toxic effect noted on previous occasion when this was given intravenously was absent.

Advantages in the use of this drug are *viz.*; the reduction of the average duration of suppression of urine, and reduction of the duration of acute stage and period of excretion of vibrios, latter being an important factor from epidemiological standpoint.

## VIROLOGY.

### 25. Vaccination of day-old chicks against Fowl-pox using the egg propagated virus.

S. G. IYER, S. B. V. RAO and B. M. THAKRAL, Izatnagar, U.P.

Iumunisation of chicks below six weeks of age with fowl pox scab virus proves unsatisfactory owing to severe systemic reactions resulting in a heightening of inter-current infections and/or retardation in growth. Day-old chicks were vaccinated without any ill effects with a field strain of fowl pox virus modified by passages in embryonated eggs. The vaccine is prepared from infected membranes in the fifteenth passage of the virus, in concentrations of 4 and 8 per cent in 25 per cent glycerine/broth and pH 7.4. The vaccination in 4,340 birds produced uniformly good "takes", followed by solid immunity, so far, up to six months. Tests reveal that this is a stable, economical product, rich and uniform in virus content which can replace fowl pox scab vaccine.

### 26. Chick Embryo Vaccine against Fowl-pox.

S. B. V. RAO, B. M. THAKRAL and D. R. RAMNANI, Izatnagar, U.P.

Isolation of the fowl pox virus from infected scabs with the aid of streptomycin and penicillin is described. The technique of passage of virus in embryos is described. Histo-pathological changes in the chorio-allantoic membrane, the virus titre, and serum neutralization tests are given.

### 27. Foot-and-mouth disease.

N. S. DATT and C. SEETHARAMAN, Mukteswar-Kumaun.

(i) No record is available in this country to indicate the reduction in milk production incidental on an attack of Foot-and-Mouth disease. The authors conducted observations on the effect on the milk yield of (a) the English cross bred, (b) the Afghan and (c) the Hill cattle resulting from a natural attack of Foot-and-Mouth disease in the dairy herd at

Mukteswar. The maximum percentage reduction in the total daily production amongst these animals was 53.0, 15.7 and 32.2 respectively.

(ii) The authors demonstrated the presence of virus in the milk of six out of eight cows running a course of Foot-and-Mouth disease. The excretion of the virus started as early as 72 hours prior to the actual onset of the disease and in certain cases the virus continued to be excreted for as long as 72 to 96 hours after the commencement of the disease in clinical form. The appearance of the virus in milk secretion did not appear to concur with the height of temperature reaction.

## PROTOZOOLOGY.

### 28. Chemical tests in Bovine Surra.

H. N. RAY and R. BHASKARAN, Mukteswar-Kumaun.

The authors have discussed the usefulness of the various chemical diagnostic methods, used for detecting latent Trypanosomiasis, in the bovines.

It is shown that for all practical purposes the Stilbamidine (M.B. 744) test (Ray 1950), is as much dependable as the Complement Fixation Test. Other tests as the Formolgel, Mercuric Chloride test (Bennett 1928-29), and the Nitric Acid tests (Jones 1935),, gave capricious results.

Just as the Mercuric Chloride test is able to detect camel Typanosomiasis, earlier than the Complement Fixation Test, the Stilbamidine (M.B. 744) test, could detect cattle Surra earlier than the Complement Fixation Test, in most cases.

### 29. A simple method of isolating and obtaining infection with single Trypanosomes (T. Evansi) and some preliminary observations on the virulence of single cell strains.

H. N. RAY and R. S. SUNDARAM, Mukteswar-Kumaun.

1. A simple method of isolating a single trypanosome in cell-free horse serum is given.
2. Infection with the single trypanosome is obtained by discharging the trypanosome into the peritoneal cavity through a laparotomy wound, from a capillary pipette.
3. The prepatent period of infection in white rats during the period of four months of observation showed a gradual extension from 6 days to 15 to 20 days.
4. Single cell strains after several passages through white rats showed a marked decrease in virulence for white mice.

## ENTOMOLOGY.

### 30. Application of Benzene Hexachloride ("Gammexane") in the control of Ectoparasites of Dairy Cattle and its effect on Milk Yield.

B. C. BASU, C. M. SEN GUPTA and P. BALARAMA MENON,
Izatnagar, U.P.

Gamma benzene hexachloride, of 0.001 per cent, 0.002 per cent, 0.003 per cent and 0.005 per cent dilutions were tried on sixteen dairy cows divided into four batches of four animals each with four controls. The spraying was conducted for a month and about 60 c.c. of the solution was sprayed on each cow on each occasion.

Animals in batches I, II, III and IV were sprayed once with a 0.001 per cent solution every day, with 0.002 per cent solution every alternate day, with a 0.003 per cent solution every week and with a 0.005 per cent solution at the beginning of the month respectively. Animals of batch V remained untreated.

The milk record was maintained during this period of spraying and a month preceding and following the operation.

Of the four different trials, daily spraying of 0.001 per cent of gamma benzene hexachloride was found to be more effective than the rest as it showed an increase of 11.6 per cent in milk yield. Batch II showed an increase of 9.9 per cent, Batch III 5.4 per cent and Batch IV 3.1 per cent.

We recorded previously the maximum apparent increase of 11.3 per cent in milk yield when the animals were sprayed with 0.1 per cent solution of DDT.

### 31. Feeding of Organic Insecticides to Chickens and its effect on the control of Argas Persicus Oken.

P. BALARAMA MENON, C. M. SEN GUPTA and B. C. BASU,
Izatnagar, U.P.

Batches of *Argas persicus* Oken (poultry tick) were fed at different intervals on chickens which were previously dosed with varying doses of Lethane B 71, Rhothane D 3 and Toxaphene (technically pure) orally.

Lethane B 71 did not prove to be satisfactory for the control of ticks by this method as with safe dosages of the drug in the birds the percentage of kill of ticks obtained was very low. The mortality rate of *A. persicus* was as low as 0 per cent and 7 per cent when they were fed on birds previously dosed with 0.5 gm. per kilogram body weight after 3 days and 7 days respectively. Lethane was toxic to birds in doses of 1 gm. per kilogram body weight, a dose of 0.5 gm. per kilogram body weight was also not well tolerated.

Batches of *A. persicus* when fed at varying intervals on birds previously subjected to oral administration of different doses of Rhothane D 3 varying from 0.25 gm. to 1.0 gm. per kilogram body weight showed a mortality rate varying from 22 per cent to 88 per cent and 56 per cent to 95 per cent in 3 and 7 days respectively after feeding on the birds. Rhothane, too, proved to be lethal to birds in doses of 0.25 to 1.0 gm. per kilogram body weight.

Batches of *A. persicus* when fed at varying intervals on birds previously subjected to oral administration of different doses of Toxaphene (technically pure) varying from 0.25 to 1.0 gm. per kilogram body weight showed a mortality rate varying from 27 per cent to 100 per cent and 73 per cent to 100 per cent in 3 days and 7 days respectively after feeding the ticks. Toxaphene was tolerated by the birds in doses up to 0.5 gm. per kilogram body weight. It proved to be lethal when administered in a single dose of 1 gm. per kilogram body weight or in two doses of 0.5 gm. each.

### 32. Laboratory trials for the control of poultry tick Argas Persicus Oken.

KARAM CHAND, Hissar.

Preliminary trials were conducted for the control of larvae and the adults of *Argas persicus*. For the former, dipping in methylated spirit, derris solution, or dusting with gammaxene, yielded good results. For the latter, destruction of the infected fowl houses seems to be the best, but where it is not possible, some insecticide has to be used to limit their number; of these an emulsion consisting of washing soap and kerosene in water, has yielded satisfactory results. Gammaxene P 520 suspension (1 in 20) in water and gammaxene D. 025 dust also yielded a cent per cent kill.

### 33. Use of Lorexane cream in the treatment and prevention of Myiasis in livestock.

C. M. SEN GUPTA, P. BALARAMA MENON and B. C. BASU, Izatnagar, U.P.

"Lorexane" cream contains 0.1 per cent of pure gamma isomer of benzene hexachloride in combination with 0.1 per cent of proflavine hemisulphate.

The cream was tried on six myiasis cases (calves of cow and buffalo) due to larval infestation of calliphorid flies. The wounds were cleaned and the cream was rubbed well in the wounds and the surrounding skin. In no case living maggots were found after the second day and no fresh attack on the same wound was noticed for a long period.

### 34. Microscopic studies of the Histo-Pathological changes in a calf skin following a bite by the tick Boophilus microplus.

B. N. SONI and D. D. NAGPAL, Mukteswar-Kumaun.

Histo-pathological study of the abrasion on the skin caused by the bites of the tick *B. microplus* reveals that the cells of the epidermis at the seat of the bite show nuclear degeneration resulting in cornification of these cells. Crowding of fibroblasts at the site of inflammation is seen in the dermal layer. There is break in the continuity of the collagen fibres and the direction of these fibres is slightly changed.

### 34A. The hazard to man and domestic animals from modern insecticides.

R. S. SRIVASTAVA and H. M. L. SRIVASTAVA, Lucknow, U.P.

The use of any insecticide on wide scale must be preceded by a thorough study of its toxicity to man and domestic animals. In case an insecticide is harmful to human health, great care and precautions are needed in its application to avoid hazards. The hazards may be occurring at different stages eg. in the manufacturing plant, in the home, in formulation and mixing, in field application and finally in the consumption of contaminated goods. The precautions and care to avoid these hazards have been described. The hazards to man and domestic animals by modern insecticides such as DDT, BHC, Parathion, Chlordane, Aldrin and Dieldrin have been discussed.

## PATHOLOGY.

### 35. Nutritional œdema and consumption level in yet another food scarcity area.

S. B. LAL, Public Health Laboratories, Patna.

A diet survey on 144 families in a part of the district of Darbhanga

(Bihar) was done in 1943. In 1951 the district suffered from food scarcity due to drought, early excessive rains followed by drought. A resurvey of the same area on the same population was done in 1951. Intake of the nutrients was adequate in 1943 but had considerably come down in 1951, though intake of vitamin $B_1$ was adequate, the caloric intake was down by 52 per cent in poor classes and 25 per cent in slightly better class people. Protein intake was very low in 1951.

21 cases of nutritional oedema were observed their age or ages being 30-50 years. Average age was 41.8 years in case of males and 35.6 for females while the weight was 94.5 and 85.6 lbs. respectively. Sixty cases with no oedema were also studied in the same area. There was no significant difference in the weight of the two groups. No cardiac or renal damages was observed in the oedema cases and none had vericose veins. Intake of vitamin $B_1$ was adequate and there was no sign of $B_1$ deficiency, of the symptoms observed, the most significant was palpitation, and nocturnal polyuria, oedema was mostly confined to legs but some had puffiness of face and eye lids. The total protein content, specific gravity and haemoglobin of both the oedema and non-oedema cases were estimated and values compared with normals. There was no significant difference in any of the values between oedema and non-oedema cases and the normal values except total protein which was significantly lower than normal in both oedema and non-oedema cases.

It has been concluded that the oedema was of nutritional origin and a suggestion has been made that the oedema may be due to increased premeability of tissue cells.

### 36. Fatty infiltration and hepatic injury in rats induced by experimental diets.

### I. Treatment with choline, methionine and protein digests.

G. C. ESH and U. P. BASU, Calcutta.

By feeding the weanling rats synthetic diets composed of low protein low fat, low protein high fat and diets containing very low levels of methionine and choline, varying degrees of hepatic fatty infiltration, degeneration of paranchymatous cells in the liver and kidney haemorrhage could be produced. The extent or severity of the abnormalities depended on the nature of the diet and upon the length of time the particular ration fed. Choline, methionine and protein hydrolysates therapy at different stages of disorders was attempted. Limited data indicate that while most of the excess fat from the liver is removed by feeding the above lipotropic factors within a short time, short time feeding does not bring much improvement towards the regeneration of hepatic parenchyma. Improvement was appreciable when protein digest supplemented with methionine was fed to animals. The position of lipotropic factors as beneficial therapeutic agent in dietary hepatic injuries is discussed.

### 37. Melanomata in Dogs.

GANTI A. SASTRI, Mukteswar-Kumaun.

A detailed account has been given of one malignant tumour encountered by the author in a Dalmatian breed of dog. The primary tumour was on the thigh with metastases into the spleen.

### 38. Inhibitory action of aureomycin on the activity of guinea pig muscle hexokinase.

R. MUKHERJEE, Mukteswar-Kumaun.

Aureomycin is toxic to guinea-pigs and certain other species of animals. It seems probable that the drug interfered with the activity of some essential enzyme (s).

At high concentrations (500 micrograms per ml. reaction mixture), the drug inhibited the hexokinase activity of guinea-pig muscle extracts markedly, while at moderate concentrations (150 micrograms per ml.) the influence was small. The hexokinase activity was measured with the Warburg apparatus.

## POULTRY NUTRITION.

### 39. Jowar (Sorghum Vulgare) as a substitute for yellow maize in poultry rations.

T. S. KRISHNAN, B. M. THAKRAL, and H. P. TANDON,
Izatnagar, U.P.

An experiment to find out the efficiency of *jowar* to replace yellow maize either entirely or by replacing half the maize with *jowar* in the ration of 0-8 weeks chicks was carried out. It was noticed that maize fed chicks made the most economic gains, followed by *jowar* + maize (50:50) and *jowar* alone, in descending order. It would appear that in the case of very young chicks, i.e., 0-8 weeks of age, *jowar* is not as good as maize when fed as the sole cereal component of the ration.

### 40. Poultry nutrition—maize versus mixed cereals.

S. G. IYER and H. P. TANDON.

Experiments were carried out to study the effect of substituting a mixture of cereals by a single cereal (maize) in the ration of laying pullets. The laying performance of the pullets fed on a single cereal supplemented with meat offals, lime stone and greens, was quite satisfactory. They utilised food efficiently for egg production and maintained their body weight satisfactorily during the experimental period. The fertility and hatchability of the eggs laid by them was slightly low probably due to the total elimination of skimmed milk from the ration.

Poultry may be fed with maize alone with the other essential supplements such as minerals, animal proteins and greens.

### 41. Value of "churn" brand protective mineral feed for Poultry.

T. S. KRISHNAN and B. M. THAKRAL, Izatnagar, U.P.

The value of "Churn" brand protective mineral feed No. 105, in poultry ration, has been studied on 0-8 weeks' chicks. It was observed that 3 per cent was about the highest safe level at which it could be fed to young growing chicks. It supplies at this level only about 60 per cent of the recommended optimum allowance of calcium for such stock. When fed at this level, chicks required 10.3 per cent more food than similar ones fed on a standard ration, to make unit gain. It proved to be over thrice as costly as the salt and lime stone it replaced. It is therefore concluded, that, unless for special reasons such a mineral supplement is to be fed, the standard practice of feeding only salt and lime stone grit, is the cheapest, without sacrificing efficiency.

### 42. A note on availability of nutrients from jowar as a single cereal for poultry.

A. K. PAL, R. N. SRIVASTAVA and S. G. IYER, Izatnagar, U.P.

Scarcity of poultry feed has favoured the use of *jowar* (Sorghum vulgare). *Jowar* is thought to cause gastro-enteritis. Digestibility trials were therefore undertaken and *jowar* was fed without addition of any other feed to six adult White Leghorn cocks.

The percentage of retention of crude protein was low. The positive balance for phosphorus and negative for Mg have been noted. By a method of processing, however, the indications are that the availability is further depressed. Jowar does not seem to be palatable singled feed and this is further accentuated by processing. The processing consisted of boiling, washing and straining. There were two cases of enteritis out of 12 birds, put on long feeding tests.

## HAEMATOLOGY.

### 43. A study of some chemical constituents of blood of improved Indian fowl (Gallus gallus).

G. RAMCHANDRA, A. K. PAL and R. N. SRIVASTAVA, Izatnagar, U.P.

In this study an attempt has been made to establish standard figures for the major constituents of the fowl blood.

Growing Indian male chickens beginning from 8 weeks of age were examined. A total of 24 male chickens divided into six different age groups were put under experiments. Determinations were made of haemoglobin and sugar in blood, and inorganic phosphorus, Ca, Mg and total proteins in the sera. Whereas concentration of most of the constituents agree well with the figures reported abroad for exotic breeds, haemoglobin concentrations seem to be lower. Study in the line of iron and copper metabolism is emphasized.

### 44. Studies on the blood of Mules. I. Hæmatology.

GANTI A. SASTRY and M. R. DHANDA, Mukteswar-Kumaun.

With a view to determine the normal haematological data in mules, the blood of ten mules kept at an altitude of nearly 8,000 ft. above sea level was examined and the following mean values (with ranges note in brackets) were observed:

Erythrocytes: 7.225 millions per C.mm. (6.285 to 8.64); Packed cell volume: (%)39.1 (33.0 to 46.0); Haemoglobin content in gms. %: 14.323 (11.6 to 17.4); Mean corpuscular volume in C.:54.174 (52.5 to 58.03); Mean corpuscular haemoglobin concentration (%): 36.564 (35.15 to 39.0); Leucocytes in thousands per c.mm.: 11.704 (8.4 to 15.4); Differential leucocyte picture: Neutrophils (%): 51.47 (35.0 to 67.0); Lymphocytes (%): 39.19 (25.7 to 45.0); Monocytes (%) 2.68 (1.0 to 4.7); Eosinophils (%): 6.45 (3.6 to 9.0); Basophils (%): 0.21 (0 to 1.0); Nuclear Index: above 30; N:L ratio: 0.64

to 2.65; Fragility of the erythrocytes: Laking beginning at 0.52 to 0.58% of NaCl soln. and laking complete at 0.34 to 0.36% NaCl soln; Clotting time-in minutes: 15.0 to 23.0 Prothrombin time in seconds: 18.8 to 23.0; Extracorpuscular volume (%) 15.0 to 23.3; Weltman coagulation band. between 3 and 5; Icterus Index in units: 6.4 to 16.6; Bilirubin content in mgm. (%): 0.5 to 0.95; Reticulocytes—nil; Mean corpuscular diameter in μ 6.826; Mean corpuscular thickness in μ 1.49.

To have a comparative idea, the above estimations were made in ten horses also and the following significant differences were observed:

1. The red cells were larger in mules.
2. The packed cell volume, haemoglobin content and mean corpuscular volume were slightly higher in the mules.
3. A slight higher leucocyte count in mules.
4. Fewer basophils in the mules.
5. A shorter prothrombin time in horses.
6. Higher incterus index in horses.
7. Lower bilirubin content of the sera in mules.

### 45. Studies on the blood of Mules. II. Chemical.

GANTI A. SASTRY and M. R. DHANDA, Mukteswar-Kumaun.

The calcium, inorganic phosphorus, magnesium and protein contents of the sera of ten mules were estimated and for comparison, similar estimations were made in horses. The following ranges were observed:—

| Animal. | Ca. in mgms. % | P in mgms. % | Mg. in mgms. % | Total protein in gms. % | Albumin in gms. % | Total globulin in gms. % | Alpha-globulin in gms. % | Beta-globulin in gms. % | Gamma-globulin in gms. % | Albumin globulin ratio. |
|---|---|---|---|---|---|---|---|---|---|---|
| Mules | 12.76 to 15.12 | 2.0 to 2.93 | 1.77 to 2.3 | 6.3 to 7.7 | 3.15 to 3.9 | 3.1 to 4.1 | 0.75 to 1.25 | 0.7 to 1.575 | 0.95 to 2.05 | 0.809 to 1.26 |
| Horses | 13.5 to 15.57 | 2.4 to 3.03 | 1.61 to 2.25 | 6.4 to 7.8 | 3.15 to 3.7 | 3.1 to 4.3 | 0.7 to 1.35 | 0.85 to 1.675 | 1.3 to 1.675 | 0.813 to 1.09 |

The following significant differences in the sera of the two species of animals were observed:—

1. A slight higher calcium content in horses.
2. A slightly lower inorganic phosphorus content in mules.
3. A decidedly higher gamma globulin content in mules.

## ANIMAL GENETICS AND REPRODUCTIVE PHYSIOLOGY.

### 46. Sheath character of Hariana cattle, its relation with milk yield and its inheritance.

R. B. SINGH and S. K. SAHA, Mathura, U.P.

Long sheath in bulls and bullocks is considered to be a bad qualification in cattle in India. If sheath can be removed from Indian cattle without reducing the milk yield, it may solve one of the biggest problems of cattle breeding in our country. In order to tackle the problem successfully, it was essential to find out the relation of sheath with milk yield and mode of inheritance of this character.

Two groups of calves, one having long sheath and the other having very small sheath of negligible size were selected at random for this study. In each group the number of calves was eleven. The mothers of long sheathed calves were found to give 1819 lbs. of milk on an average per cow per lactation. The best cow in this group yielded 3108 lbs. of milk in one lactation (best one). The milk yield of poorest cow was 563 lbs. When the milk yield of the mothers of the calves having no sheath was studied, it was found that this group did not show any significant difference from the first one in milk yield. The data go to show that the mothers of calves having long or small sheath behave in the same way regarding their milk yield.

The conclusion was put to test by another method of study. As the male animals have sheath, some cows possess naval flap and others are without it. Seventy-five cows having naval flap and sixty-three without naval flap were studied regarding their milk yield. In the first group the average milk yield per cow per lactation came to 2539 lbs. The second group having an average milk yield production of 2305 lbs. per cow per lactation does not show any significant difference from the first one in the milk yield. It is, therefore, concluded that sheath character of Hariana is in no way related to milk yield.

The study about the mode of inheritance of this character has so far shown that this character is inherited but the actual mode of inheritance is still under investigation.

### 47. Induction of ovulation in Buffalo with pregnant mare serum gonadotrophin (PMS).

S. N. LUKTUKE and P. BHATTACHARYA, Izatnagar, U.P.

The investigation was conducted on 98 buffaloes. Out of these six animals were treated at the Military Dairy Farm, Bareilly, 15 were referred by the owners for treatment and the remaining were experimental animals slaughtered at various intervals after the injection of PMS. The doses of PMS administered varied from 750 I.U.—4500 I.U. The animals were artificially inseminated at the induced heat.

In most of the animals which had anoestrous ovaries, oestrus and ovulation could be induced in 3-4 days after the injection of PMS. No ovulation could be induced by administration of PMS in animals during early pregnancy and during the mid-oestrous cycle in the presence of corpus luteum. Multiple ovulations took place when the hormone was injected in the follicular phase and the ova recovered from these animals were mostly fertilized. Multiovulations were also induced by injecting PMS in the presence of corpus luteum which was removed at various intervals thereafter. The number of fertilized ova recovered in this group was, however, less than the former group of animals. Among the animals that were left to calves after PMS treatment, 2 out of 4 heifers and 8 out of 18 buffalo cows conceived. Some variation in response to PMS is shown by the buffaloes when compared to cows. This is possibly due to the probable difference in ratio of FSH and LH content of anterior pituitary in the buffalo.

### 48. Oestrous cycle in Sahiwal Cow.

S. N. LUKTUKE, A.S. P. RAO and P. BHATTACHARYA,
Izatnagar, U.P.

Data on length of oestrous cycle in Sahiwal cow were collected from three different farms. In all 864 oestrous cycles from 768 animals were studied. 704 oestrous cycles, i.e., 81.48%, fell within a range of 18-27 days. The mean average length of oestrous cycle for heifers was 21.00±0.07 and for cows was 21.51±0.08 days. 51, i.e., (5.90%) oestrous cycles fell within a range of 36 to 45 days and the mean centered round 40 days. These were obviously double cycles and the heat must have been missed either because of short duration or of less intensity. Age, lactation and season did not seem to have much influence on the length of oestrous cycle.

### 49. The effect of administration of Equine Gonadotrophin on the Ascorbic Acid content of Buffalo adrenals.

S. N. LUKTUKE, K. PAL and P. BHATTACHARYA, Izatnagar, U.P.

Ascorbic acid content of adrenals obtained from buffalo cows at certain stages of oestrous cycle and early pregnancy, has been estimated. Forty-eight out of 85 buffaloes in this investigation were injected subcutaneously with equine gonadotrophin in doses varying from 1500 I.U.—4500 I.U. These animals were slaughtered 4-14 days after injection. The remaining animals acted as controls. There was no significant difference in the ascorbic acid content of the adrenal in the various groups studied. Pituitary stimulation by equine gonadotrophin did not seem to affect the normal level of ascorbic acid in adrenals, significantly.

### 50. Induction of lactation in cows with stilboestrol.

R. N. MOHAN, Mathura, U.P.

In 1947-48 winter, 20 non-lactating animals in Calcutta were subjected to repeated intramuscular injections of stilboestrol up to a total dosage of 70 to 310 mg. spread over 1 to 5 weeks. The animals so treated were—4 multiparous sterile cows, 2 multiparous cows and 3 heifers which had aborted and were not lactating, and 11 nulliparous heifer calves most of which had never come into oestrus.

Under the conditions of the experiment, there was no lactation response in the cows in spite of the total dose being 310 mg. administered in 5 weeks. All except 3 heifer calves responded more or less quickly with milk yields comparable to a normal lactation. The maximum daily yield recorded was 17½ lb. within 2 months of the first stilboestrol injection.

All treated animals remained in good health during the observation period of 9 months after the experiment and showed distinct improvement in body condition, some even putting on fat. Copious but clear mucoid discharge, however, persisted at the vulva in all animals for several weeks after the injections. Many were inclined to stand with an arched back and in some the tail heads became distinctly raised.

### 51. Some observations on size of hen eggs.

S. G. IYER and H. P. TANDON, Izatnagar, U.P.

The performance of a pedigreed strain of White leghorn pullet has been studied. Birds hatched in January, February and March matured in October of the same year.

The egg size is at its lowest at the time of maturity, it increased in winter months and the maximum size was recorded in February. The size, however, declined gradually from April onwards, but from August or September it showed a tendency to increase. Significant variations were observed in the weight of eggs between one fowl and another, both at the beginning of laying and during the course of first year of laying. Whether the egg was small or big at the time of maturity, the maximum size was recorded in February. In one and the same breed or strain, the birds differed considerably in regard to the size of eggs laid. Selective breeding for standard egg size (2 oz. per egg) is, therefore, recommended for poultry improvement.

### 52. The incidence of blood and meat spots in eggs.

S. BOSE and T. D. MAHADEVAN, Izatnagar, U.P.

Experiments were carried out to study the incidence of blood and meat spots in the eggs produced in the Institute Poultry Farm, Izatnagar. The incidence of blood spots had been low since 1940. The percentage of eggs containing meat spots, however, was quite high in 1940, but decreased to a low figure during the recent years. The improved results were due to the policy of culling the persistent offenders prior to making up the breeding pens. The occurence of blood and meat spots was highest in the Rhode Island Red pullets and lowest in the *Desi* pulletts. It seems that there are hereditary tendencies in the incidence of blood and meat spots either on a basis of breed or of family differences.

### 53. Field application of artificial insemination in India—IV.

P. BHATTACHARYA and S. S. PRABHU, Izatnagar, U.P.

This is the fourth scientific report on the results of field application of artificial insemination in India. The report is based on 8477 inseminations performed on cows and buffaloes. Altogether 790 ejacuates were drawn from 21 bulls belonging to two species stationed at Indian Veterinary Research Institute centres located at Calcutta, Patna and Bangalore during 1949. The average reaction time of bulls belonging to *Bos indicus* was 584.10 seconds (range 7 to 3960 seconds) and the average volume of semen was 4.22 c.c. (range 0.8 to 12 c.c.). Altogether 7533 cows were inseminated with an average rate of fertility of 57. 7%. The highest unmber of cows served from a single ejaculum was 47 and the highest unmber of cows served by a bull in an year was 1809. In case of *Bos bubalis,* the average reaction time was 365.18 seconds (range 7 to 3600 seconds). The average volume of semen was 1.81 c.c. (range 0.3 to 6.00 c.c.) Altogether 994 buffalo cows were inseminated with an average rate of fertility of 58.35%. The highest number of buffaloes served from a single ejaculum was 16 and the highest number of buffaloes served by a bull during the year was 523. These figures show considerable improvement on previous years' like figures in case of both species.

In addition, the effect of three factors, namely, (i) skill of the Artificial Insemination operators, (ii) Stage of oestrum of the animal inseminated and (iii) Length of storage of semen outside the body, on fertility was studied. Each of these factors affected fertility significantly.

After taking these into consideration, the wide variation in fertility rates (46.32% to 72.83%) observed among bulls could not be satisfactorily explained and appear to suggest the operation of additional factors that should receive due regard at the time of selection of bulls for artificial insemination service.

On the question of the number of bulls to be maintained at the field stations for artificial insemination work, it was shown that two bulls of a gven breed, provided they satisfied other conditions, were ample for a centre with an annual target of 4000 inseminations and using only a single breed for cattle improvement.

## CLIMATOLOGY.

### 54. Influence of acclimatisation on the performance of newly imported poultry.

S. G. IYER and H. P. TANDON, Izatnagar, U.P.

Utility strains of White Leghorns and Rhode Island Reds imported from Australia in 1939 are maintained at the Indian Veterinary Research Institute by selective breeding. The Australian strain revealed no significant loss of egg production in the first year of its import. Barred Plymouth Rock imported into our farm early in 1949 behaved in a most erratic manner in the first year of their import. While the incubation and rearing results were not unsatisfactory, the viability and laying performance of a total of 18 B.P.R. pullets revealed interesting features. None of the B.P.R. pullets survived the full period of 365 days after maturity, majority of them dying within 4 or 5 months after laying the first egg. Laying performance of these unacclimatised birds was poor. The yield was 3 eggs from a pullet during a period of 89 days, as against the best bird of the flock laying 79 eggs during a period of 203 days, but there was only one bird that gave this figure. The average number of eggs reckoned for a period of 100 days was 25. Over 90 per cent of the pullets of acclimatised White Leghorns and Rhode Island Reds survived for 12 months and more after maturity and laid relatively well.

In the second generation of breeding the laying performance of the Barred Plymouth Rock strain was better. About 60 per cent of the selected pullets lived for full one year and more after laying the first egg in the second generation.

### 55. Popultry farming at high altitudes.

S. G. IYER, M. R. DHANDA, T. S. KRISHNAN and K. N. JOSHI,
Izatnagar, U.P.

A study of poultry keeping in the hills was undertaken at Mukteswar-Kumaun, about 7500 feet above sea level. Ready-to-lay pullets of White Leghorn, Rhode Island Red and grades of these breeds were sent from the Izatnagar Poultry Farm and their record of egg production over a year was studied. They were housed in a *pucca* shed with attached runs, enclosed by wire netting and having green grasses planted in them. Grain and mash system of feeding was followed. It was observed that the flock average worked out to 146.4 eggs per head, during the first year. The mortality experienced was 8.0 per cent during the above period. It appears, with care and attention, poultry farming in the hills could be carried on with success.

### 56. Egg production of different breeds of Fowls during summer months in India.

S.G. IYER and H.P. TANDON, Izatnagar, U.P.

In India diverse climate conditions exist. Knowledge of the effect exerted by these variable seasons is essential. Egg production of certain common breeds in April, May and June has been studied and compared with the production during the other months of the year from the time of sexual maturity. The pullets were hatched during January to March 1950 and October was the month when most of the birds started laying. In ascending order the egg production during April, May and June of the year following that in which the pullets were hatched stands as under:—

Indian fowl, White Leghorn, Rhode Island Red, Barred Plymouth Rock.

For easy reference the figures of egg production are given below:- -

| Breed | Total number of eggs laid during April, May & June | Total annual egg production. |
|---|---|---|
| W.L. | 30.1 | 148.8 |
| R.I.R. | 36.0 | 167.3 |
| Indian | 21.6 | 137.6 |
| B.P.R. | 41.6 | 168.1 |

Barred Plymouth Rocks seem to have considerable potentialities as ideal for economic production and improvement of the non-descript fowls in the villages, which go to form over 98% of the country's total poultry population. The results also reveal that Rhodes may be recommended as a suitable breed for the Uttar Pradesh in preference to White Leghorns. The Indian strain has been considerably improved by selective breeding for better egg production and better egg size than the average village hen in our Union, laying only 53 eggs in a year.

## PHARMACOLOGY AND TOXICOLOGY.

### 57. Pharmacognostic and Pharmacological investigations on the roots of Rauwolfia canescens Linn.

M. D. CHAKRAVARTY and S. C. DUTTA, Calcutta.

The paper deals with Pharmacognostic characters of the roots of *Rauwolfia canescens, viz.*, morphology, macroscopic and microscopic appearance and characters of powdered drugs, and data have been presented for distinguishing it from the Serpentina roots. The chemical investigation has been carried on regarding percentage of total alkaloids, alcoholic extract, water soluble extract, and oleo-resin, which has been further analysed to find out the percentage of oils and resins in it. The pharmacological investigation includes a preliminary study on the toxicity of the roots. The drug has been found to be an adrenolytic agent and investigations are in progress to see whether it is a sympatholytic in all aspects. Because of its marked adrenolytic property *R. canescens* promises to be a better hypotensive drug than the *serpentina* variety.

### 58. Effect of root diameter on the chemical constituents of Rauwolfia Serpentina roots.

S. C. DUTTA, Calcutta.

The roots of the plant *Rauwolfia serpentina* which have been in use in India for a long time as an insanity cure have been investigated chemically regarding their alkaloid content. It has been found that the thinner roots are more rich in alkaloid content than the thicker ones. The microscopic examination also shows that the starch bearing tissue predominates in thick older roots and that the resin-cell tissue that contains the alkaloids are relatively more abundant in roots of smaller diameters.

### 59. Akav: a digitalis like cattle poison.

N. M. TIWARI, Nagpur.

Akav is a plant indigenous to India. Pharmacology of its extract is studied on animals. It is said to be heart poison and violent local irritant. Orally it produces no symptoms in ruminants, whereas dogs show symptoms. Isolated frogs heart shows increased amplitude of contraction, extrasystole followed by slowing. Effect is not abolished by atropine. In dogs carotid pulse tracing records sustained rise of blood pressure, increase in pulse wave after injection of infusion whereas milk, serum and alcoholic extract show initial fall followed by rise of blood pressure. Toxic doses produce marked brady cardia. Effect on electrocardiogram: Within 5 minutes of intravenous injection it produces increase in P.R. interval to double the normal and inversion of T waves, and shows no gastro-intestinal symptoms. It increases the movements and tone of rabbits intestine and uterus when added in minute quantities. Effect is not abolished by any drug. It acts powerfully on adynamic fatigued plain muscles, i.e., intestine, uterus, and heart and postpones fatigue. Its cardio-tonic action is quick like ouabain and further studies are being done to see if it can be therapeutically used as quick acting cardiac tonic.

## TECHNIQUE AND GENERAL.

### 60. A simplified apparatus for the micro-electrophoresis of proteins on filter-paper.

R. MUKHERJEE, Mukteswar-Kumaun.

Recently, a method of fractionating proteins by electrophoresis on filter paper strips has been developed in Europe and in the U.S.A. Certain special equipments are required for this work. In the simplified apparatus developed by the present author, the essential components are: two Coplin staining jars, glass slides, two carbon rods extracted from used flash-light cells, a bell-jar, and filter paper strips (Whatman No. 1). If the local mains supply is A.C., radio batteries may be used as the source of direct current. Thus, it is possible to use the qualitative technique in any clinical laboratory with little extra expenditure.

With this apparatus and using a veronal buffer, a separation of about 4.5 cm. between serum albumin and gamma-globulin was obtained after electrophoresis for 5 hours. The different fractions were identified after staining and washing the strips, as usual. 0.21 ml. of serum was sufficient for a qualitative analysis in duplicate.

### 61. Studies on the preservation of duck eggs.

S. BOSE and T. D. MAHADEVAN, Izatnagar, U.P.

The ducks with their higher output of eggs per bird in India, as compared to the village hens, and their larger size of eggs, can be of considerable importance for increasing food production in the country. Experiments were carried out to study the quality factors of duck eggs and to devise effective methods for their preservation. The heat-treatment of duck eggs in water at 130°F. for 30 minutes caused coagulation of the thick whites of duck eggs. The above condition was, however, optimum for processing hen eggs. Further trials revealed that the heat treatment of duck eggs in water at 126°F. for 10 minutes effected the desired destruction of the embryo, without any coagulation of the thick white. The processing improved the keeping quality of duck eggs even under adverse conditions of storage. The rate of deterioration of quality as determined by the conditions of yolk, albumen, aircell size and by the losses in weight of eggs, was very much slower in duck eggs than hen eggs. The slower rate of deterioration of quality was due to the larger content of mucin in the thick whites of duck eggs and to the presence of the smaller number of pores in the duck's egg shell.

As regards cooking quality, the yolks of duck eggs were as satisfactory as were the yolks of hen eggs. The whites, however, showed considerable variation. The whites of duck eggs beat up slowly and did not give so large a volume or stand up so well as did the whites from hen eggs. The poor whipping quality was due to the larger content of mucin in the thick whites of duck eggs and to the presence of smaller number of pores in the duck's egg shell. As regards cooking quality, the yolks of duck eggs were as satisfactory as were the yolks of hen eggs. The whites, however, showed considerable variation. The whites of duck eggs beat up slowly and did not give so large a volume or stand up so well as did the whites from hen eggs. The poor whipping quality was due to the larger content of mucin in the thick whites. When cakes were made from equal weights of duck and hen eggs, the cakes in which duck eggs were used, did not rise as much as those made from hen eggs. But the cakes made from equal weights of duck and hen yolks respectively, gave uniformly good results both with regard to size and texture.

in the thick whites.

### 62. A comparative study of rice husk, saw dust and wheat bhoosa as floor litter for chick rearing.

T. S. KRISHNAN, B. M. THAKRAL and H. P. TANDON, Izatnagar, U.P.

Three sets of experiments were conducted with each of the above three substances and in each test the growth rate, food consumption for unit gain of body weight, mortality as well as the amount and cost of litter used, were studied. The results indicate that all three materials are suitable for this purpose and are of about equal efficiency. Since rice husk is the cheapest, it is recommended for use.

# 40th INDIAN SCIENCE CONGRESS, LUCKNOW, 1953
## SECTION OF BOTANY

*President*:—Dr. R. K. SAKSENA.

## ALGAE

### 1. The Enzymes of Myxophyceae.

Arya Bhusan Gupta, Kanpur.

Enzymes play a vital role in the life processes of plants but there is no adequate record of the enzymic activity of algae and that of Myxophyceae in particular. In view of the doubtful nature of reserve food materials in Myxophyceae the present investigation was undertaken on three forms belonging to this group namely *Nostoc* sp., *Scytonema hofmanni* and *Fischerella mucicola*.

The material for this investigation was obtained from practically bacteria free cultures of these forms. It was dried and powdered, and used for the estimation of intracellular enzymic activities, while the liquid medium of these cultures was used for the determination of the respective extracellular enzymic activity. Some of the recent methods were employed for the determination of the following enzymes:—amylase, invertase, glycolytic enzymes, lypase, proteolytic enzymes, innulase, raffinase, catalase, oxidase, peroxidase, cellulase and pectinase.

The various experiments performed show that the algae in question do not liberate extracellular enzymes. The tests performed for intracellular amylase and glycolytic enzymes yielded negative results. The invertase activity however, if at all present, is extremely feeble. There is a distinct intracellular lipase and proteolytic activity indicating that these substances are more widely utilised in Myxophyceae than is at present assumed. The catalase activity is also found to be universal, but there is no oxidase or peroxidase activity. Negative results have also been obtained with respect to innulase, raffinase, cellulase and pectinase.

### 2. Euastriella, a new genus in the family Desmidiaceae.

Ella A. Gonzalves and S. G. Bharati, Dharwar.

This paper is a description of an interesting desmid collected from Londa, 44 miles from Dharwar It shows slight resemblances to four genera of desmids viz. *Staurastrum*, *Micrasterias*, *Euastrum* and *Euastridium*, but because of other striking dissimilarities, it cannot be regarded as a species of any of these genera. Hence it is described as the type species of a new genus.

### 3. On the mode of branching in a South Indian form of Brachytrichia balani (Ll.) B. & F.

M. O. P. Iyengar and T. V. Desikachary, Madras.

The mode of development of the reverse 'V'-shaped branching in *Brachytrichia balani* is worked out in detail. In all, five modes of development of this type of branching have been described. It does not seem to have been realised earlier that this type of branching can be derived in more than one way.

In addition to the above type of V'-shaped branching, true lateral branching are also commonly met with in the present alga.

The type of reverse 'V'-shaped branching described by Bornet and Flahault and Ercegovic and other authors were not found in this algae. The V-shaped branching is essentially brought about by the activity of one of the daughter cells derived by the oblique division of a single parent cell. The branch is formed first and later a 'V'-shaped structure is developed. The important part played by the sister cell of the branch-bearing cell on the other side of the trichome in the development of the V-shaped branching does not appear to have been recognised before.

It is pointed out that due to the absence of a break in the continuity of the branch with the main parent trichome this type of branching cannot be considered as a type of false branching, as it has hitherto been considered, but must be treated as a kind of true branching. Consequently it is suggested that the family Mastigocladaceae should be placed under the Stigonematales after a detailed study of the branching in other members of the Mastigocladaceae.

### 4. On the mode of branching in some members of the Stigonematales.

M. O. P. Iyengar and T. V. Desikachary, Madras.

Mode of Branching was studied in the following members of the Stigonematales:—

(1) *Hapalosiphon delicatulus,* (2) *H. stuhlmanni,* (3) *H. hibernicus,* (4) *Hapalosiphon* sp., (5) *Mastigocladus laminosus,* var *indicus,* (6) *Nostochopsis lobatus* and (7) *Mastigocladopsis jogensis.*

*Hapalosiphon* spp., are characterised by true branching formed by a longitudinal division of the branch-forming cell. In all the species the cell that goes to form the branch, or 'the branch—mother cell', undergoes one or more transverse divisions giving rise to shorter cells which later give rise to the branches. The cell at the base of the branch, or the 'branch-bearing cell', does not undergo any division after the formation of the branch. But occasionally in some species and more frequently in Hapalosiphon sp. from Elliot's Beach the branch bearing cell undergoes an oblique or transverse division.

In *Nostochopsis* also true branching is formed in similar way as in *a Hapalosiphon* but the preceding division of the mother cell is very marked. The branch-bearing cell shows a peculiar tendency to arch outwards in the direction of the branch in the form of a reverse 'V'. Here also the branch-bearing cell often shows a tendency to division and consequently a 'V'-shaped branching is brought about which is quite different from that seen in *Brachytrichia Balani.*

***Mastigocladus laminosus*** var. ***indicus*** shows both true lateral branching as in ***Hapalosiphon*** and reverse 'V'-shaped branching somewhat as in ***Brachytrichia.***

***Mastigocladopsis jogensis*** shows also true lateral branching in addition to reverse 'V'-shaped branching as in ***Mastigocladus*** and occasionally as in ***Brachytrichia.***

The mode of development of all these branchings is described in detail and their significance discussed.

### 5. A general consideration of the branching in the Myxophyceæ.

M. O. P. Iyengar and T. V. Desikachary, Madras.

Bornet and Flahault have distinguished two types of branching among the blue-green algae, the true branching and false branching. The modes of development of these two types of branching are discussed in detail.

A third type of branching, reverse 'V'-shaped branching, has been distinguished in recent times. The mode of formation of this type of branching is also discussed.

In the past the reverse 'V'-shaped branching was included under false branching. The authors are of the opinion that in as much as in the formation of this branching there is no break in the continuity of the main filament and the branch, these branches should be treated as true branching types.

Consequent on this view certain modifications to the existing systems of classification are suggested.

### 6. Note on the occurrence of three-pored heterocysts in Brachytrichia balani (Ll.) B. & F.

M. O. P. Iyengar and T. V. Desikachary, Madras.

Only two kinds of heterocysts are known so far, one-pored heterocysts placed basally or terminally and two-pored intercalary heterocysts.

A new type of heterocyst was observed in a *Brachytrichia Balani* from Pamban. These were formed at the base of branches and possessed three pores on the three sides in which the original heterocyst forming cell was in contact with the neighbouring cells.

### 7. Critical notes on Some of the fresh-water algae, collected from Hyderabad State".

M. R. Suxena, Hyderabad.

With a view to the compilation of an algal flora of Hyderabad State the author started collecting material of fresh-water and submerged algae from different parts of Hyderabad State as early as 1940. The present contribution deals with some of the interesting forms encountered during this collection from different aquatic habitats. The species described belong to the *Chlorophyceae,* (Chlorococeales Ulotrichales, Conjugales, Charales) *Bacillariophyceae* and *Myxophyceae.* Many of the species are new records for India. The data concerning the geographical distribution of the previously recorded species in India is also given.

### 8. On some algæ growing on tentage.

T. V. Desikachary, Madras.

Algae growing on exposed tentage as a factor in the destruction of the fabric was investigated by the Technical Establishment Laboratories, Kanpur. The following algae have been found to be growing on these tentage fabrics. *Trebouxia chodoniae, Stichococcus bacillaris, Myxosarcina concinna forma, Dactylococcopsis raphidioides, Phormidium luridum, Ph. tenue, Ph. cebennense, Nostoc commune,* and *Plectonema gracillimum.*

### 9. Iyengariella tirupatiensis, gen. et sp. nov., a new member of the Stigonematales.

T. V. Desikachary, Sagar.

A Blue-green alga which appeared to be new was collected on submerged rocks in a mountain stream at Tirupati. This alga showed very interesting features and is described in detail. It has an attached prostrate or basal portion and a free erect portion. The prostrate portion shows true branching. The mode of branching is described. The free erect filaments usually ended in a hair. The Alga is non-heterocystous. The chief modes of propagation are by hormogones which germinated *in situ* and by the formation of spores.

The alga appears to be unique and new and is named *Iyengariella tirupatiensis* gen. et sp. nov. This genus comes under the Stigonematales on account of its true branching. This genus is tentatively placed in the family Loefgreniaceae.

### 10. Note on a collection of Iyengariella tirupatiensis Desikachary from Pachmarhi Hills, Madhya Pradesh.

T. V. Desikachary and L. P. Mall, Sagar.

*Iyengariella tirupatiensis* was recently recorded from a stream in the Tirupati Hills in Madras State. The present authors have recorded the algae for a second time in a fast flowing stream in the Pachmarhi Hills, Madhya Pradesh.

It agrees in all respects with the original diagnosis of the genus and confirms the establishment of the genus.

### 11. An Aegagropilous Blue-green alga from a lake at Chingleput, Madras State.

T. V. Desikachary and K. Ramakrishnan, Madras.

An aegagropilous blue-green alga is described. The major form which goes to form this is *Schizothrix lacustris.* Other algae recorded as being included in the aegagrophilous ball are *Chroococcus targidus, Aphanothece nidulans, Aphanothece pallida, Aphanocapsa roeseana, Oscillatoria ornata* forma, *Lyngbya* sp., (*L. spirulinoides* ?), *Cosmarium bengalense, Cosmarium pseudopyramidatum, Oedogonium* sp., *Scytonema* sp., and *Nostoc* sp.

The probable mode of formation of these balls is also discussed.

## BACTERIA AND FUNGI

### 12. Studies on the occurrence of Bacteria in Angiospermic Flowers—I.

T. C. N. Singh and (Miss) K. Bhuvaneshwari, Annamalainagar.

During the course of a dermal study of the sepals and petals of the flowers of Bignoniaceae, the occurrence of bacteria was first chancedly observed in the petals of one of the species. Subsequently a close systematic study was undertaken and so far 55 species spread over 21 families have been investigated. The results of the occurrence of Bacteria floral part-wise are detailed as under specifying the species under each head. (K = calyx, C=Corolla, A=Androecium, and G=Gynoecium).

*Group K* : *Bougainvillaea spectabilis* Willd. (Nyctaginaceae).

*Group KC* : *Canna indica* Linn. (Cannaceae); *Lantana indica* Linn. (*Verbenaceae*); *Beloperone* sp. (Acanthaceae); *Vicoa indica* DC. (Compositae); *Chrysanthimum* sp. (Compositae).

*Group KCA* : *Mussaenda frondosa* Linn. (Rubiaceae); *Caesalpinia pulcherrima* SW. (Caesalpinae).

*Group KCG* : *Psidium guajava* Linn. (Myrtaceae).

*Group CA* : *Quisqualis indica* Linn. (Combretaceae).

*Group CAG* : *Hibiscus scizopetalous* Linn. (Malcaceae).

*Group KCAG* : *Phyllanthron* sp. (Bignoniaceae); *Tabebuia pallida* Macq *Glericidia maculata* Linn. (Papilonaceae); *Barleria cuspidata* Nees., *B. cristata* Linn., *Thunbergia fragrans* Roxb., *Justicia tranquebarensis* Linn. *Adhatoda vasica* Nees. (Acanthaceae); *Spathodea companulata* Deauv., *Tecoma stans* Fuss., *T. capensis* Linn., *Crescentia cujete* Linn., (Bignoniaceae); *Abrus precatorius* Linn., *Clitoria turnatea* Linn., *Dolichas lablab* Linn., *Crotalaria laburnifolia* Linn., (Papilinoceae); *Zinnia* sp., *Cosmas* sp., (Compositae); *Gossypium barbedense* Linn., *Hibiscus rosasinensis* Linn., (Malvaceae); *Allamanda cathartica* Linn., *Vinca rosea* Linn., *Nerium odorum* Solan *Vallaris solanaceae* O. Kze., *Thevitia nerifolia* Juss. (Apocynaceae); *Ixora coccimia* Linn., (Rubiaceae): *Cephalandra indica* Naud., (Cucurbitaceae); *Angelonia grandiflora* C. Moor. (Scrophulariaceae); *Ipomoea biloba* Forsk. (Convolvulacea); *Trichodesma indicum* R. Br. (Boraginaceae); *Petunia hybrida* Hort., *Solanum trilobatum* Linn., (Solanaceae); *Plumbago zylanica* Linn., (Plumbaginaceae); *Clerodendron inerme* Gaertn. (Verbinaceae); *Guaicum officinalis* Linn., (Zygophyllaceae); *Delonix regia* Raf. (Caesalpinae); *Ionidium suffruiticosum* Ging. (Violaceae); *Balsam impatiens* Linn., (Balsaminae); *Turnera ulmifolia* Linn. (Turneraceae).

### 13. Further studies on the occurrence of Bacteria in the stems and leaves of plants (Regional)—III.

T. C. N. Singh and N. S. Subba Rao, Annamalainagar.

On previous occasions reports have been made from this laboratory on the occurrence of intracellular bacteria in stems and leaves of flowering plants in and around Annamalainagar (T. C. N. Singh and V. R. Rajagopalan, *Ind. Sci. Cong.* 1950 and 1951). In the present investigation this study has been extended to plants (on regional basis) growing in other parts of South India.

Altogether 71 plants in fresh condition collected at random from different places were examined—43 species from Quilon, Alleppey and Ernakulam and 28 species from Tambaram, Madras and Mahabalipuram.

The intracellular bacteria are either rod-shaped or globoid and show vigorous movement. The plants examined never show any pathological signs. Their possible role in the metabolism of plants is discussed.

Further work is in progress and the study is being extended to other regions of India as well.

### 14. Studies in the diseases of Mangifera indica Linn.

B. B. Sharma, Lucknow.

The paper deals with the malformations in mango blossoms. A survey of the orchards of Lucknow and its neighbourhood has revealed that Dasehri, Khajri and Husnara are very highly affected (30-60%) while other varieties are less affected. The disease is found in scattered trees all over the orchard and recurs year after year on the affected trees. Five different forms of malformations from different mango varieties have been distinguished. The morphology and the histopathology of these have been described. None of these malformations are caused by fungi or bacteria. Treatment of the healthy inflorescences with the bacteria free extract of the malformed blossoms of the same variety failed to reproduce the disease. Branch injections with Knop's solution and trace elements separately at the initial stage of the disease, to check or cure it, yielded negative results. The disease is a non-pathogenic one and seems to be associated with some internal physiological disorder.

### 15. The study of the life history and the mode of infection of Ustilago paradoxa Syd. & Butl. on Echinochloa frumentacea (Roxb.) Link.

B. B. Sharma, Lucknow.

A detailed study has been made of the life history and the mode of infection of *Ustilago paradoxa*, the cause of Smut in 'Sawan' or 'Banti'. Kulkarni (1922) had found 90% infection with the seed borne fungus, while the results of the infectional study made here show that the seed borne and the soil borne spores produce a maximum of 60% and 34% disease respectively.

The fungus gains entry through the general surface of the radicle of the seedlings excluding the hypocotyl and the tip region. The most effective period of the infection is when the seedlings are two days old (60%). On the third day stage of the seedlings the percentage of infection is 26% and on the fifth day stage 4%; beyond this there is no infection at all.

A study of the varietal resistance using sixteen varieties of 'Sawan' in all (13 from the Uttar Pradesh and 3 from the Madhya Pradesh) showed that the Madhya Pradesh varieties, MP 59-80 and MP 54-19 are the most resistant showing 1% and 2% infection respectively whereas the highest resistant among the Uttar Pradesh varieties is T.4108 only recording 2.7% disease. All others are susceptible including the two improved varieties namely T.25 and T.46.

The histopathology of the infected plants and the seedlings of various ages has been studied in detail by cutting sections and macerations.

### 16. Latent infection in the fruits of Aegle marmelos Correa.

B. B. Sharma, Lucknow.

The paper deals with an internal rot of 'Bel' (*Aegle marmelos* Correa). The disease manifests itself in the stored condition. The entire mesocrap is consumed by the developing pathogen inside, which ultimately becomes a shrunken mass. The infection is mainly from below the stalk end region of the fruits and spreads all over the internal face of the outer shell as well as on the mesocrap. Three fungi, viz., *Botrytis* sp. (?), *Aspergillus niger* and *Aspergillus nidulans* have been found to be associated with the disease. Experiments have been shown that these three fungi are all present in the fruit as latent infection and produce the disease only when the fruits are kept in storage. *Botrytis sp.* (?) has been found to be present in very young apparently healthy fruits, whereas at a later stage of the maturity of fruits, when they are still healthy, both *A. niger* and *A. nidulans* make their appearance. The pathogenicity of each of these three fungi has been established experimentally both with fruits on the tree as well as with detached fruits under the laboratory conditions. The histopathology of the infected fruits and the mode of perennation of the pathogen during the period of latency has been studied in detail.

### 17. Alternaria-like Mutation of Stemphylium.

B. Padhi, Cuttack.

At the University of California, the author investigated a leaf spot disease of lettuce, *Lactuca sativa* L. caused by *Stemphylium botryosum* Wall.f. *lactucum*. In course of the work, once a variant appeared in one of the single spore cultures growing on pea-straw agar plates. In the variant clone, it was found that the conidia, unlike in the *Stemphylium*, were borne in clusters and in each cluster there were many long chains, both simple and branched. In the chains there were several distinctly beaked spores.

The new clone was cultured and was found to grow true to its form in all cases tried. It was a true mutant. It possesses characters definitely like those of *Alternaria*.

Wiltshire (2) in 1932 had reported a reversible *Stemphylium-Alternaria* saltation. But the present work is distinctly more definitive and extended.

The mutation shows phylogenetic relationship of *Alternaria* with *Stemphylium*.

### 18. The effect of the source of carbon on the assimilability of Ammonium and Nitrate Nitrogen by Phytophthora cactorum (Leb. et Cohn) Schroet.

B. S. Mehrotra, Allahabad.

A review of the literature, though scanty, shows that carbon source is one of the factors influencing the assimilability of the source of nitrogen.

In media containing singly dextrose, levulose, galactose, starch and glycerine as sources of carbon the growth of *Phytophthora cactorum* (Leb. et Cohn) Schroet was best with ammonium nitrogen (as source of nitrogen) than with nitrate nitrogen. Exceptionally when sucrose was used as a source of carbon nitrate nitrogen supported much better growth than ammonium nitrogen.

Further, ammonium nitrate was found to be a better source of nitrogen than potassium, sodium-nitrate or ammonium chloride separately.

At the end of the period of incubation (16 days) the media containing nitrate nitrogen remained almost neutral while those containing ammonium chloride or ammonium nitrate turned acidic. The explanation for this is given in the text of the paper.

### 19. Studies on the Lichens of India.

#### 1. *A note on Lichens from Simla.*

D. D. Awasthi, Lucknow.

Our knowledge of the Lichen Flora of Simla is rather meagre. In a short hurried trip to Simla in June 1952 the author collected 20 specimens of Lichens in a small area bordered at the base by the Mall-Sanjauli-Chhota Simla-Mall Road and rising up to the Jakhu top, thus confined within an altitude of 7200-8000 feet.

This small collection consists of 9 crustaceous, 8 foliose and 3 fruticose types. The crustaceous lichens have several more species which could not be collected. The fruticose and foliose types represent nearly all the species available in that area. While it has not yet been possible to identify the crustaceous types the foliose types are (1) *Parmelia Arnoldi* DR., (2) *Parmelia cylisphora* (Ach.) Vain. (*P. caperata* Ach.), (3) *Parmelia nilgherrensis* Nyl., (4) *Parmelia cirrhata* Fr., (5) *Physcia setosa* (Ach.) Nyl., (6) *Peltigera rufescens* (Weis.) Humb., (7) *Lobarina scrobiculata* (Scop.) Ach., (8) *Leptogium Menziesii* (Sw.) Mont. and that the fruticose types are (1) *Ramalina punctata* Ras., (2) *Usnea orientalis* Mot., and (3) *Cladonia bacillaris* Nyl.

All these species excepting one occur on the tree trunks or branches. *Parmelia Arnoldi* and *P. cylisphora* which are most common are conspicuously seen adpressed to the bark of the *Cedrus deodara* trunks. Only *Peltigera rufescens* occurs on ground among mosses. The different crustaceous types occur either on tree trunks or on stones. In contrast to the northern face of the hill, the lichens occur only on the southern face, a condition explained as an effect of exposure to sunlight and wind.

The paper deals with detailed description, morphology and distribution of the fruticose and foliose lichens of this collection.

### 20. The Development of the Teleutospore of Ravenelia Mitteri Syd.

H. P. Chowdhury and Daya Nand Pant, Lucknow.

The paper deals with the development of teleutospore of *Ravenelia Mitteri* Syd. parasitic on *Indigofera leptostachya* DC. The development of the teleutospore, which has not hitherto been studied in relation to the nuclear condition, has been studied in some detail.

It has been found that the teleutospore starts as a fascicle of hyphae in the hypodermal regions of the host. The fascicle pushes up and undergoes various divisions. The first is a transverse one which divides it into an upper cell—the spore initial cell, and a lower cell—the stalk initial cell. The stalk initial does not divide further but elongates to form the stalk cell. The spore initial further divides transversely and longitudinally to form a dome of three rows of cells—two rows of spore cells and one row of cyst cells. A thickened shell all round the spore-mass is secreted which is the thickened outer wall of the spore cells.

All the cells in the head are binucleate to begin with and later on in the head cells nuclear fusion starts with the result that the spore cells ultimately become uninucleate but the nuclear fusion does not take place simultaneously in all the head cells but proceeds from the top downwards and from the centre towards the periphery. The stalk cells, however, remain binucleate throughout and are, therefore, mycelial in their morphological nature.

### 21. Infection of bananas by Fusarium Oxysporum in storage.

(Miss) K. Barthakur and H. K. Baruah, Gauhati.

BANANAS are often found to be spoiled during storage, infection being of the nature of softening and gradual blackening of the tissues. *Fusarium Oxysporum* has been isolated from the decaying tissues. The fungus attacks both unripe and ripe fruits through wounds whereas sound fruits are not frequently attacked. Ripe fruits show greater susceptibility to infection than unripe ones. Different varieties of bananas show different degrees of resistance to infection, for example: the rate of spread of the fungus is greater on Athiya variety than on Chenichampa and Manohar varieties of bananas, both in the unripe and ripe condition. The rate of growth of the fungus parallels, on the whole, the rate observed on banana skin decoction agar and banana pulp extract agar. The blackening which is associated with the rotting of the fruit is probably enzymatic due to the presence of peroxidase and dehydrogenase in the fruit itself since the preparations obtained from extracts of the fungus do not indicate the presence of oxidase, peroxidase, dehydrogenase and catalase. There is, however, evidence of the presence of phenol oxidases since the preparations of *Fusarium Oxysporum* extract decolourised such dyes as gentian violet, neutral red and methylene blue. *Fusarium* extracts caused nacuration of banana tissues indicating the action of lamellase and pectinpolygalacturonase and also caused changes in viscosity of the starch solution indicating thus the amylase activity.

### 22. Morphological and Cytological studies in Albugo species on Ipomoea aquatica and Merremia emarginata.

K. M. Saffeulla, Bangalore.

Two species of *Albugo* are described in the present paper. One of them is commonly found on the leaves of *Ipomoea aquatica* Forsk, causing severe infection and inciting deformation of shoots and flower stalks; the other is found on *Merremia emarginata* inciting systemic infection of shoots. Regarding the identity of the species on *Ipomoea aquatica*, it is placed under *A. ipomoeae-aquaticae* Sawada based on the description given by Sawada. The fungus parasitising *Merremia emarginata* is presented as a variety of *A. evolvuli.*

Germination of sporangia was observed in *A. ipomoeae-aquaticae.* The sporangia germinate within 4 hours when incubated at 15°c, while no germination took place in the material incubated at room temperature (24°c), even after two days.

In the two species of *Albugo* under study the first simultaneous division of the nuclei takes place in both oogonia and antheridia. The spindles of the dividing nuclei do not show any stage of zonation as in *A. bliti, A. portulacas,* and other species. The nuclear membrane disappears prior to the metaphase stage of the nuclear division. The mature oogonium is uninucleate with a faintly staining coenocentrum. The oogonial wall which is thickened and shows papillate projections even from the early stages, forms the outermost layer of the mature oospore.

The mature oospores show in both the species 8 to 16 free nuclei the fusion nucleus having undergone 3 to 4 successive divisions in this process. In the fungus on *Merremia emarginata* 16 chromosomes were counted in the metaphase plate of first division of fusion nucleus and 8 in the second division during the metaphase stage.

### 23. Occurence of Curvularia lunata (Wakker) Boedijn in discoloured rice seedlings and leaves in Hyderabad-Dn.

M. Abdus Salam and P. N. Rao, Hyderabad.

Considerable importance is attached to the fungal discolouration of rice kernels which is increasingly prevalent in Hyderabad-Dn., Bombay, C. P., Bengal and other places, as reported by various workers.

In India occurence of *Curvularia* sp. (*specifera*) on diseased seedlings of rice has been reported by Mundkar (1946) in his annual report. Padwick and Ganguly (1946) reported the occurence of *Curvularia lunata* from Bengal in association with *Ophiobolus miyabeanus* and *Trichoconis* *caudata* causing stackburn disease of rice. Padmanabhan from Cuttack (1948) has isolated *Curvularia lunata* from diseased rice seedlings, but hitherto this disease has not been reported as predominantly occurring at Hyderabad. The fungus causes damage to the paddy crop and great loss to the revenue of the State. The obvious reason being the obscurity of the symptoms of the pathogen on the rice plant in its early stages, and in the advanced stage its similarity in external symptoms to that of "Brown spot" disease of rice.

Studies (1952) at the Plant Pathological Laboratory, Botany Department, Osmania University, on diseased rice seedlings and leaves showed the presence of the pathogen which has tentatively been identified as *Curvularia lunata* (Wakk) Boedijn. The samples have been collected from district Gulbarga, Aurangabad, Warangal and Nizamabad which are the rice growing areas of the state; as well as Hyderabad proper (Ambarpeth Rice Seed Farm and Agricultural Experiment Station, Himayatsagar). Further work on the pathogenicity of the fungus is under progress and trials are also undertaken to ascertain the most practicable methods for the control of the disease.

### 24. Leaf blight of Blighia sapida Akee.

M. Kamal, Lucknow.

In this paper an hitherto unreported disease of *Blighia sapida* has been described. It causes serious damage to the leaves.

The disease starts as a small etiolated spot on the leaf surface during the rainy season. This spot gradually develops, coalesces with other similar spots and finally covers the entire leaf surface after which defoliation takes place. The dark specks in the blighted area are due to the emergence of numerous dark coloured conidia. Only older leaves are susceptible to the disease.

Isolations made under aseptic conditions have shown that a sp. of Curvularia which has been identified as *Curvularia lunata* (Wakker) Boed. is constantly associated with the disease. The morphological character of the fungus has been studied.

The spraying of the undamaged young as well as mature leaves with conidia did not produce the disease. The disease, however, was produced experimentally by wounding the mature leaves and inoculating them with hypha from monohyphal culture of *Curvularia lunata* isolated from the deceased region. The pathogen was reisolated invariably from experimentally diseased leaves and the control leaves remained unaffected. Younger leaves treated similarly remained unaffected.

### 25. On the Biology of Pestalozzia palmivorum causing brown spots on coconut palm leaves.

(Miss) R. Agarwalla and H. K. Baruah, Gauhati.

*PESTALOZZIA PALMIVORUM* responsible for frequently causing brown spots on coconut palm leaves, has been isolated. The fungus is a wound parasite, penetrating only through abrasions or punctures caused by insects on leaves whereas sound leaves are not infected. In the case of treatment of leaves with chloroform vapour resulting in the loss of semipermeability of the epidermal mambrane, infection takes place through sound tissues. Young tender leaves are more susceptible to infection than mature ones. The range of pathogenicity of the fungus has been studied and the fungus, if inoculated on wounded leaves, causes brownish black spots on leaves of widely different species. On infected leaves showing black spots there is decrease in the starch-content which indicates the amylolytic activities of the fungus: preparations of *Pestalozzia Palmivorum* extracts in vitro hydrolyse starch to a considerable extent. Peroxidase, Oxygenase and Catalase reactions are not to any extent marked in healthy and infected leaf extracts.

### 26. Fungus Flora of Allahabad Soil.

R. K. Saksena and B. S. Mehrotra, Allahabad.

The soil fungi from a field in Allahabad have been isolated. For this purpose a modification of Goddard's method has been tried with success, avoiding all surface contamination as far as possible, taking fungi actually existing in the soil.

The 'planting out' technique was supplemented by 'Direct Inoculation Method', as described by Waksman (1931).

The pH of the soil (determined by Kuhn's Colorimetric method) was between 6.8 and 7 and differed little at various depths.

The following genera of fungi have been isolated: *Zygorhynchus* (3 species), *Chaetomium, Cladosporium, Curvularia, Pestalotia, Sporotrichum, Oospora, Aspergillus* (8 species), *Penicillium* (3 species), *Paecilomyces, Fusarium* (2 species), *Neocosmospora,* and *Rhizoctonia.*

The following fungi have been newly reported from soil: *Pestalotia* sp., *Paecilomyces varioti* Bainier, *Neocosmospora vasinfecta* E. F. Smith.

The new records from the Indian soil are *Aspergillus amstelodami* (Mangin) Thom and Church emend Thom and Raper, *Aspergillus luchuensis* series Thom and Raper, *Aspergillus variecolor* (Berk. and Brown) Thom and Raper, *Penicillium sanguifluus* (Sopp) Biourge, *Paecilomyces varioti* Bainier, *Oospora variabilis* (Lindner) Lindau, *Sporotrichum epigaeum* Brunard var. *terrestre* Daszew, *Pestalotia* sp., and *Neocosmospora vasinfecta* E. F. Smith.

### 27. Effect of Sulpha-drugs on the growth of Pestalotia spp.

R. N. Tandon and M. P. Tandon, Allahabad.

The effect of various sulpha-drugs on *Pestalotia-malorum* and *Pestalotia psidii* isolated from rotten apples and mummified guavas respectively was studied. Fungi-static action of sulphanilamide and sulphathiozole was quite pronounced. Sulphapyridine also supported only feeble growth, but fair amount of growth was observed on sulphamerazine and sulphaguanidine. Excellent growth of *P. psidii* was observed on sulphadiazine and that was even better than on the control, but with *P. malorum* its fungistatic action was quite pronounced.

Microscopic examination revealed that some of the Sulpha drugs were capable of causing morphological abnormality in mycelium and spores of both the organisms. Production of long chains of chlamydospores of different colours was a common feature whenever poor growth was observed.

### 28. Black point disease of wheat.

R. N. Tandon, P. Das and J. P. Srivastava, Allahabad.

1. Different varieties of wheat were artificially inoculated by *A. tenuis*. None of them were completely immune but NP 52 and R7 showed much resistance. C13, C228, R2, R1, R8, R10, R4 and F.F.I., were severely infected and consequently they showed much loss in their germination capacity.

2. *A. tenuis* could also infect the various parts of the plant preferably leaves which eventually turned yellow. NP 52 was not susceptible to this attack.

3. Infection of the plant or grains could not be developed through soil.

4. Infections were obtained on certain varieties of barley grains. T5 was very severely infected and 35/44 was comparatively less infected. Inoculation on the various parts of barley plant failed to produce any result.

5. Thermal death point of the fungus was found to be 54°C, but at such high temperature the germination of the grains was adversely affected hence hot water treatment did not prove successful.

6. Though the trouble could not be controlled fully but benzene vapours or sulphur dust greatly diminished the damage.

### 29. Storage rot of Colocasia antiquorum caused by Fusarium Coeruleum (Lib.) Sacc.

R. N. Tandon and S. N. Mitra, Allahabad.

1. A dry storage rot of the corms of *Colocasia antiquorum* was observed and *Fusarium coeruleum* was Isolated. Artificial inoculations developed the original symptoms.

2. Infection could take place through injury only and the disease did not appear after the wound cork was developed.

3. Infection started between 12-15°C. There was no infection at lower temperatures and the progress increased with the increase of temperature upto 35°C.

4. There was no infection at low soil moisture content but the disease increased with the increase of soil moisture from 30-90%. The progress was retarded above 90%.

5. Dry rot was developed at lower percentages of soil moisture and a wet rot appeared at higher humidities.

6. Soil as well as diseased corms of the previous year could cause the infection.

7. The storage of corms at 8°C or the treatment of corms with 0.1% mercuric chloride solution checked the infection. Other methods of storage (viz., storage in sand, storage in heaps, storage in single layers) did not prevent the losses.

8. The parastism of this fungus was not markedly specialized. It could attack a number of other hosts including potatoes, sweet potatoes and 'Bengali Banda'.

### 30. Some Soil fungi from Sagar.

S. B. Saksena and G. K. Murty, Sagar.

Soil fungi were studied from two localities—a fallow wheat field and a neighbouring forest area of Sagar. From each spot, two samples were taken, one from the upper two inches of the soil and the other from the next two inches in depth. Thirteen species belonging to 8 genera were isolated. Three species viz., *Gliocladium deliquescens, Spondylocladium australe* and *Macrosporium commune* which are reported for the first time from Indian soils are described in detail. The chemical and physical characteristics of the soil were recorded for temperature, organic carbon, nitrate contnt, pH value, Base deficiency and water content.

### 31. Diseases of Strawberry in Kumaon and their control.

S. K. Bose, Jeolikote.

In Kumaon, severe leaf-spot diseases of Strawberry were found to be due to a number of fungi. Spot with yellow brown centre surrounded by purple border were caused by *Dendrophoma obscurans* (E & E) And. Anthracnose was due to *Diplocarpon earliana* (E & E) Sacc. Both these fungi are hitherto unrecorded from India. Field scale experiments with Perenox (0.25%), lime sulphur (1:20-21° Baume), Dithane Z-78 (o.25%) showed that the three fungicides were equally effective in controlling the leaf-spot diseases of strawberry.

### 32. Powdery mildew of mango in Kumaon and its control.

S. K. Bose, Jeolikote.

Powdery mildew of mango is known in the plains of India. It attacks the inflorescence and seedlings. However, in Kumaon the fungus is a severe parasite of the leaves of full grown mango trees, apart from its usual incidence on the inflorescence. The damage is most severe at 2000-4000 feet, where the fungus may be found throughout the year. During spring, the mildew appears in epidemic form, causing premature leaf and fruit fall. The fungus has been found to be *Oidium magniferae* Berthet. Field trials with Perenox (0.25%), spersul (0.3%), Thiovit (0.3%), and Sandolin (0.3%), during the last two years showed that Perenox was ineffective in controlling the disease. Sandolin was superior to the other fungicides. The three sulphur preparations, namely, Thiovit, lime sulphur and spersul were equally effective in significantly controlling the mildew.

### 33. A new species of Entomophthora on beetles.

S. K. Bose, Jeolikote.

During July 1950, a severe mortality of the chestnut defoliating beetles(*Brahmina* sp.) was found to be caused by a species of *Entomophthora* new to science. The fungus was characterised by digitate external conidiophores, with papillate ovoid conidia. The zygospores were formed by direct bulging of the wall of the fused area of U, h, or H shaped hyphal rated. The epispore was thick walled and spiny, and could not be separated by pressure. The anchoring haustoria were disc like, lohed, with fine papilae on the under side. A single specimen of the apple defoliating beetle *Anomela rufiventris* Redt. was found to be killed by the fungus in the Govt. Gardens, Chaubattia. The fungus has been designated as *Entomophthora brahiminae* Bose and Mehta sp. nov.

### 34. Sooty-mould disease of Citrus in the Kumaon and its control.

S. K. Bose, Jeolikote.

Sooty-mould is common on the cultivated species of citrus, such as orange, malta orange, lemon, lime, grape fruit etc. The imperfect stage of the fungus was found to be *Microzyphium* sp. The perfect stage was found to be *Chaetothyrium citri* (Arn.) Fisher. The fungus was found associated with the common whitefly *Dialeurodes citri* Ashm. and the smoky winged fly *Aleurocanthes husaini*. The combined effect of the fungus and insect often leads to distortion of the leaves and often defoliation. The affected fruits usually remain smaller and blackened. Field trial during the last three years showed that Sandolin (0.5% with Euphyton 0.2%) was most effective against this fungus. DDT (0.5%), thiovit (1%), Spersul (0.5%) and lime sulphur (1:10—14° Baume) were equally effective and significantly superior to fish oil rosin soap and control.

### 35. An entomogenous fungus on the citrus whitefly Dialeurodes citri Asmm.

S. K. Bose, Jeolikote.

A severe mortality of the citurs whitefly (*Dialeurodes citri*) was noticed at Bhimtal, during March 1952. Hard fungus stroma, orange yellow in colour, appeared round the insects. The fungus was found to be a species of *Aschersonia*. The colour of the stroma structure and diamensions of the paraphyses and spores were similar to those of *Aschersonia papilata* Petch. As described by Petch the local specimens produced a greenish yellow to brownish yellow colour in the sections of the stroma when treated with a solution of caustic potash. It is proposed to identify the entomogenous fungus with *A. papillata*.

### 36. Die-back Disease of Polyalthia longifolia.

S. N. Das-Gupta and M. Kamal, Lucknow.

A new disease of *Polyalthia longifolia,* a tree widely grown in avenues and gardens is being reported in this paper.

A number of *Polyalthia* trees showing characteristic die-back symptoms were first observed at Lucknow in November 1951. The disease commences in the uppermost branches resulting in etiolation, drying up and defoliation of the affected twigs. The leaves in the advanced stage of disease are brown in colour, twisted and their margins roll upwards after which they are shed. The disease gradually advances to lower regions of the tree.

Microscopic examinations of sections of diseased twigs showed presence of hyphae in xylem vessels.

Isolations made from a number of diseased trees under aseptic conditions revealed that 4 fungi are associated with the disease, viz., *Phomopsis*, *Diplodia*, *Chaetomium* and *Fusarium.* Of these *Phomopsis* and *Dip-*

*lodia* are most predominant. The remaining on account of their scanty occurrence seem to be present as secondary infections only.

A study of spatial distribution and frequency of these isolates strongly suggests the possibility of *Phomopsis* being the casual pathogen.

Preliminary pathogenicity tests made have shown that but for one exception in the case of *Phomopsis* the isolates fail to infect vigorously growing young seedlings.

Further work regarding the mode of infection and pathogenicity is in progress and will be reported later on.

### 37. Studies in the Indian aquatic fungi
### I. On the occurrence of Indian Blastocladiales.

S. N. Das-Gupta and Rachel John (Miss), Lucknow.

Very little work has been done on the aquatic fungi of India. A scrutiny of the literature shows that only very few forms of the Chytridiales, one of the Blastocladiales and one of the Lagenidiales have been reported from this country. Saprolegniales and Peronosporales have, however, received a greater attention. Aquatic fungi, therefore, appear to be a very profitable field of study and the authors have attempted to make an exhaustive collection of the various aquatic fungi found growing as Saprophytes on leaves, twigs and other fully or partially submerged plant organs. These fungi have also been obtained by baiting with the usual baits such as hemp seed and rosaceous and other fruits. The collections were made at different times of the year from the river, tanks and ponds in the vicinity of Lucknow and a very large number of forms of aquatic fungi specially those belonging to the order of Blastocladiales were obtained.

The present paper embodies the descriptions of the morphological characters of the members of the Blastocladiales which have so far been collected. A provisional identification of the forms have been made based on the nature of the plant, size and shape of the basal cell and character of the sporangia.

### 38. Studies in the Indian aquatic fungi.
### II. On the occurrence of Indian Monoblepharidales.

S. N. Das-Gupta and Rachel John (Miss), Lucknow.

So far as the authors are aware no member of the Monoblepharidales has been reported from India. A few forms belonging to this group have been obtained from our collections. The members of this group seem to be comparatively less abundant than the members of the Blastocladiales and have been found only during certain seasons of the year. The provisional identification of the forms collected hitherto has been made and the illustrated descriptions are given in this paper.

### 39. Studies in the Indian aquatic fungi. III. On the occurrence of Indian Lagenidiales.

S. N. Das-Gupta and Rachel John (Miss), Lucknow.

The Indian Lagenidiales like most of the other groups of aquatic fungi has received very little attention. Only one member of this group has so far been reported from India. Members of this group are of infrequent occurrence and are parasitic in algae and other aquatic Phycomycetes. This paper deals with a few forms of the Indian Lagenidiales which have been collected from Lucknow and are parasitic in Spirogyra, Closterium and Saprolegnia. Provisional identification has been made and an illustrated account of these forms has been given in this paper.

### 40. Spraying and dusting trial to control blast (Piricularia Oryzae) of paddy.

Syed Vaheeduddin, Hyderabad.

This trial was conducted at Sewage Farm, Amberpet, Hyderabad where 'blast' appears practically every year, in Abi season of 1951-52. Object was to see the comparative efficacy of Perenox, Bordeaux mixture and Sulphur in controlling blast (Piricularia oryzae) diseases of paddy. The experiment was statistically laid out and replicated five times in a randomised block. The susceptible variety H.R. 19 was selected for the purpose. Plot size, under each treatment was 1/82 of an acre. Treatments were spraying of 1% Bordeaux mixture, O. 35% Perenox and dusting with Sulphur independently once and twice in the season as against untreated control. All around screens were used while spraying and dusting.

It was seen from the average individual yield data recorded that single application of Perenox gave highest yield of 1099 lbs. paddy per acre followed by single application of Bordeaux mixture, which gave 1066 lbs. paddy per acre. Spraying twice with Perenox yielded 942 lbs. paddy per acre followed by single application of sulphur yielding 911 lbs. paddy per acre. Untreated control plot gave an average yield of 599 lbs paddy per acre. The results were statistically significant.

### 41...Seed dressing trials for controlling leaf blotch (Helminthosporium) of maize.

Syed Vaheeduddin, Hyderabad.

The trial was conducted at Bornakkal in Karimnagar district of Hyderabad State in Abi season of 1951-52. The object of this field trial was to find out relative efficiency of different seed dressing fungicides in controlling the leaf blotch disease of Maize when compared to untreated control. Seeds of local maize, a suscept variety, were treated with Agrosan GN, Sulphur, Fernasan and Landisan at 4 ozs, of each fungicide to lcwt. of seed. Treated seeds were sown separately in a plot size of 1/40 of acre. The trial was replicated five times in a randomised block. One untreated control plot was maintained in each replication, for comparison. Fortnightly observation on the hincidence of disease were recorded and at harvest sepatate yield data noted. When the yields were compared Agrosan GN. gave highest yield of 1664 lbs. grain per acre followed by. 1536 lbs grain per acre with Sulphur, 1440 lbs grain per acre with Fernasan, 1344 lbs. grain per acre in Landisan when compared to 1320 lbs. grain per acre in control. The results were statistically significant.

### 42. Morphology and Environment.

V. P. Damle, Amalner.

Morphology is regarded as an external manifestation of the (innate) hereditary factors (chromosomes and genes). However, in certain cases, and especially in lower plants and animals, we find deviations from this observation and their morphology controlled by environmental factors.

During the investigation into the Physiology of Parasitism of Pythia it was revealed that the development of pronounced spines on the oogonia of *P. mastophorum,* a very significant morphological character entitling the distinction between species of Pythium, depends entirely on the environmental condition—concentration of the substrate.

Environmental factors, thus, may control the expression of Morphology, and therefore, the Morphology alone may not give finality to the distinction between the species.

Yet, these physiological results need not shake the basis and the principles of Morphogenesis (as is held by the Soviet Genetisists); their proper interpretation may still be problematic.

## BRYOPHYTA

### 43. On an abnormal carpocephalum of Asterella blumeana Nees.

S. K. Pandé and K. P. Srivastava, Lucknow.

While examining specimens of *Asterella blumeana* Nees, collected by one of the authors (Pandé), a few years ago, from the Western Himalayas, we came across a plant of this species that carried a branched carpocephalum, the branching extending down to about one third the length of the stalk. The plant is somewhat larger than the normal ones and the stalk of the receptacle is also stouter. The unbranched portion of the stalk bears two rhizoidal furrows, but each one of the branches has a single rhizoidal furrow and carries a receptacle of the normal type, the latter bearing three involucres, two of which are fertile and subtend normal perianths. Each one of the fertile involucres subtends a normal but immature sporophyte.

The discovery of such abnormal receptacles strongly supports the suggestion put forth by Cavers (1911, The inter-relationships of the Bryophyta, New Phy. Reprint No. 4) that the carpocephalum which terminates the apical growth of the thallus are formed by the repeated dichotomy of the apex. There is no difference between such a carpocephalum and the carpocephalum of the Compositae of Leitgeb in this respect.

### 44. On a species of Riella Mont. from the neighbourhood of Banaras, Uttar Pradesh, India.

S. K. Pandé, K. S. Misra and K. P. Srivastava, Lucknow.

In this paper the authors describe a species of *Riella* from the neighbourhood of Banaras first collected by K. S. Misra in 1950. The only other species of this interesting genus, known from India, is *R. indica* St. The discovery of *Riella* from Banaras extends the eastern range of the distribution of the genus by some 700 miles.

The species is monoecious and differs from *R. indica* in some important features such as sexuality, involucre etc., and can be easily distinguished from it.

The plants grow in shallow water and are attached to the ground by means of rhizoids arising from the base. When left on drying mud, as the water recedes, it grows prostrate and develops rhizoids all along the axis. The wing is broad and has wavy margin and is more or less tapering towards the base and is rotundate fulcate at the apex. The scales are few and small and variable in form. Antheridia occur in several groups in the sinuses along the margin of the wing and each group may have 8-10 or even more, 15 or 16 antheridia. Involucres are more or less globose, 8 winged, and the wings have undulate or sinuate margins. Capsule is more or less spherical and the spores are brown, densely spinous and including spines measures 75$\mu$ along the greatest diameter. Vegetative reproduction by means of gemmae, borne on the axis, is very common. The gemmae are in the form of constricted plates arc attached to the axis by the wider end. The development of the gemma and the growth of the plant from it has been followed in detail.

The species belong to the section Plicatac of Allorge (1932, in Die Pflanzenareale., Dritte Reibe, Heft 5, pp. 45-7), which includes *R. affinis* Howe and Underwood from North America, *R. cosoniana* Trab., a species from Algeria and *R. paulsenii* Porsild, a species from Central Asia. The last two species are dioecious and thus differ from the species of *Riella* from Banaras. The resemblances between this species and *Riella affinis* are, however, much closer but they differ in the size of the spore, number of antheridia in the antheridial group and some other minor details and are very probably different. The species is apparently new to science.

### 45. Studies in Indian Metzgerineæ.

S. K. Pandé and Ram Udar, Lucknow.

As far as the authors are aware, the only morphological work on the genus *Calycularia* Mitt. is that of Campbell. This species differs in certain respects from the other species of the genus. Schiffner even suggests that it should not be associated with the other species of *Calycularia*. It was, therefore, thought all the more necessary to study the morphological details of *C. crispula* Mitt. which is yet insufficiently described in works on Indian Bryology.

*C. crispula* occurs in the Western Himalayas: Dalhousie-Khajiar Road, Garhwal, Gaurikund, Kumaon, Gangolihat (Kashyap); Dhakuri, 10,000′, Munsyari, ca 10,000′, Ganguani (Pandé); and the Eastern Himalayas: Jorpokhari (Pandé); Darjeeling ca 7,000′, (Decolyet Schaul).

The plant is dioeceous. The growth of the thallus is by an apical cell somewhat like what has been described for *Fossombronia*.

The development of the sex-organs is of the usual type. The antheridia are globular, stalked and borne on the midrib, each one being covered by a scale. The archegonia occur in clusters on the dorsal side and are surrounded by an involucre laciniated above. The involucre is formed by the coalescence of the scales which develop in the beginning independently. The first division wall of the zygote is transverse. Early in the development the lower cell of embryo enlarges considerably and is rich in contents and has a prominent nucleus. It obviously takes no part in the development of the sporophyte which develops from the epibasal half alone. The details of the development of the sporophyte have been followed.

In the sporogenesis a quadripolar spindle is clearly noticed. The mature capsule is nearly spherical, dark-brown and its wall is three-layered and has characteristic fibrous thickenings in the form of thickened bars which are more prominent on the outer layer than on the inner ones. On dehiscence the wall breaks up irregularly into 2-4 valves.

### 46. Studies in Indian Metzgerineæ. I. Fossombronia himalayensis Kash.

S. K. Pandé, T. S. Mahabalé, Y. B. Raje and K. P. Srivastava, Lucknow.

The paper deals with the taxonomy and morphology of *Fossombronia himalayensis* Kash., a liverwort commonly growing in the outer and middle ranges of the Western Himalayas and the Western Ghats in India. Detailed study of the structure and development of the thallus, reproductive organs and embryo has been followed. The thallus usually develops from the tuber of the previous year and is simple or dichotomously branched. Its growing point is horizontal and the apical cell is dolabrate and has two cutting faces. It is protected by mucilage hairs and young leaves. The plant-body shows very little internal differentiation. In a transverse section the inner cells are smaller than the outer. The midrib, towards the ventral region, is inhabited by an intercellular mycorrhizal fungus. The species is monoecious and protandrous and produces large number of antheridia placed in the axils of leaves. Their development is similar to that of *F. cristula* (vide, Humphrey, H.B., 1906. The development of *Fossombronia longiseta*. Aust. Ann. Botany, 20 : 83-108). The mature antheridium is spherical or oval. The development of the archegonium follows the normal course characteristic of the Anacrogynae. In the mature archegonium the neck consists of five tiers of cells with 7-8 cells in each tier. The venter is two layered and there are five to six neck canal cells. The venter contains a ventral-canal-cell and an egg. Some cases of abnormality in the form of cells below the egg have been recorded.

The oospore divides into two cells by a transverse wall. The hypobasal cell produces the foot and the epibasal half develops into the capsule and seta. The embryo, in the early stages, is of the filamentous type. The mature capsule has a three-layered wall towards the apex but in the remaining part it is two-layered. The mature sporogonium comes out of the perianth by the elongation of the seta. The spores are lamellate and yellowish brown and are mixed with elaters and the latter have spiral thickenings on their wall. In the Western Ghats the spores mature by the end of October and rest till the advent of rains when they germinate and produce new plants. Vegetative reproduction by means of apical tuber is very common.

## PTERIDOPHYTA

### 47. Variations of leaf-form in Marsilea Quadrifoliata L.

S. C. Pandeya, Sagar.

In contradiction to Eames' (1936) description that the leaflets of of *Marsilea* vary little in form in most species, there is noticed a great variation of leaf-form in the same plant of *Marsilea quadrifoliata* L. a portion of which grows under water and the rest creeps upon the dried margins of lakes. This paper further records the development of serration at the margins of the leaflets growing on dried mud.

An analysis of the above mentioned phenomena is given.

It has been observed that the frequency distribution of the leaves in respect to leaf-area is discontinuous; from the same node are given off leaflets of variable size. It appears as Misra (1944) has observed that the variations in the leaf-area are induced when they are still developing. Correlating the morphological and physiological attributes, viz., area of leaf, depth of serrations at the margins of leaflets, and L/B ratio (as an index of leaf-shaped) it has been observed that: the leaf-area decreases with decrease in percentage of water content in soil; while serration and L/B ratio increases.

It has been concluded that soil water is probably one of the master factors responsible for bringing about the variation in the leaf-form.

### 48. Studies on Two species of Davallia.

T. S. Mahabalé and Nymphia d'Almeida, Bombay.

Two species of Davallia were investigated, *Davallia bullata* Wall and *Davallia fijiensis* H.K., the former indigenous to Bombay State and the latter cultivated. The sori in both the species are situated in the pocket-shaped indusia spread along the veins near the edges of the sporophylls. The development of the spores is nearly the same as has been described by Bower. The n- number of chromosomes obtained in *D. bullata* was ±46.

The spores germinated in both species in Knop's solution and on soil cultures. The 1st division of the sporeling is transverse, followed by three or four more divisions, giving rise to a small filament. The rhizoidal cell emerges after this, being much delayed. The original filament ends in a hair. The lower cells of this filament divide and form a spathula which becomes cordate later. The adult prothallus may be cordate or cordately-lobed, or branched. It is hermaphrodite. Antheridia appear after 3 months and archegonia a month later. The development of the antheridium, archegonium and embryo is as is in the other Polypodiaceae. The young sporophyll is linear and has branched hairs. The prothalli of *D. bullata* are nearly similar, except that they are larger than those in *D. fijiensis,* about 0.5 cm. in diameter.

The epidermal structures in the two species are different, highly characteristic of each. The subsidiary cells are nearly kidney-shaped.

The rhizome in both the species is dictyostelic. In *D. fijiensis* 16-20 vascular bundles are arranged in C-shaped manner around two large central bundles. In *D. bulleta* two inverted Cs, each made up of 14-16 vascular bundles are arranged above and below the two large central meristeles. The leaf-trace is double. In the pulvinus of *D. fijiensis*, besides the two leaf-trace bundles, several small ones are also seen. The two main bundles in *D. bullata,* as they emerge from the rhizome, fuse to form the X-shaped stele characteristic of the *Loxsoma* type. The development of the sorus shows that it changes from the gradate to mixed condition.

### 49. Anatomy and Prothallia of Gymnopteris quercifolia Bernh.

T. S. Mahabale and Tripti Biswas, Bombay.

*Gymnopteris quercifolia* is a Gymnogramoid fern widely distributed in Peninsular India and Ceylon, particularly in Travancore hills. The sori in it are naked. The creeping dorsiventral rhizome having a schizostele consisting of 4 to 6 meristeles, produces two kinds of fronds, sterile and fertile ones. Sterile fronds are large, broad, and oak-leaf-shaped; the fertile ones are long stalked and are attenuated. The venation is reticulate with free included veinlets spread in the meshes on the two sides of the mid-rib. The leaf trace is double and strap-shaped. Multicellular hairs occur on the rhizome, rachis and leaf. These hairs are glandular and their development from the epidermal cells is similar to that in *Osmunda, Angiopteris*, and *Ceratopteris*. Similar hairs are also found on the gametophytes.

The oval spores have three coats and they germinate in about a week's time and form a filament of about 10 to 20 cells. It becomes strap-shaped later. The adult prothallus is ribbon-shaped. Cushion is not uniformly developed. A few of the hairs on the prothallus are branched. The prothallus is hermaphrodite. Development of the reproductive organs is normal. On the whole the prothallus looks like the thalli of some Jungermanniaceae. Studies on other species, *G. lanceolata, G. crenata, G. contaminans* and *G. costulataare* in progress.

### 50. Life-history of Athyrium hohenckarianum Bedd.

T. S. Mahabale' and S. Venketeswaran, Bombay.

*Athyrium*, a member of the sub-family Asplenieae is available all over the Western Ghats. Out of the five species available in the Bombay State, *Athyrium hohenckarianum* Bedd. was studied in detail.

The short rhizome covered with scales, has a dictyostelic condition. Phlobaphen occurs in three to four distinct patches in the stem. The leaf trace is double. The sporangia occur asymmetrically on the veinlets. The sporogenesis is normal and shows 40 n-chromosomes. The spores when germinated in the laboratory produced more or less rounded and cordately lobed mature prothallii, half inch in diameter. The gametogenesis and embryogeny are normal.

Most of the species of *Athyrium* show apogamy followed by apospory; but this species is perfectly fertile and perhaps owes its success as a very common fern in the Western Ghats to this fact.

## ANGIOSPERMS

### 51. Studies in the viability of pollen grains.

A. T. Natarajan, Annamalainagar.

Mature anthers of ten species were collected and stored in paper packets. Samples of pollen grains were drawn periodically out of these packets and they were subjected to germination tests under three cultural media of: (a) distilled water, (b) 15% sugar + 1.5% gelatine solution and (c) coconut water.

It is interesting to note that the viability of pollon grains was retained for a minimum period of sixteen days in *Mussaenda tomentosa* Wight, (Rubiaceae), *Peltaphorum ferrugineum* Benth. (Leguminosae), and *Angelonia grandiflora* C. Moor, (Scrophulariaceae), and a maximum of twenty nine days in *Nelumbium speciosum* Willd. (Nymphaeaceae). In other cases the viability was preserved for seventeen days in *Tecoma capensis* Linn. (Bignoniaceae), nineteen days in *Ixora coccinia* Linn. (Rubiaceae), twenty days in *Martynia annua* Linn. (Martyniaceae) and *Petunia hybrida* Hort. (Solanaceae), twenty one days in *Thunbergia grandiflora* Roxb. (Acanthaceae) and twenty eight days in *Gloriosa superba* Linn. (Liliaceae).

### 52. Presence of Velamen in the Earth Roots of some species of the Asparagus (Linn.)

B. N. Mulay and B. D. Deshpande, Pilani.

(1) Velamen has been observed in the earth roots of *Asparagus*.

(2) The structural details of the velamen have been studied.

(3) No well defined exodermis is present in these roots.

(4) In a general way, the same structural details that are present in epiphytic velamen, are present in land velamen.

(5) Pitted cells have been observed in the cortex of these roots.

(6) A jacket of tracheid like cells is present surrounding the endodermis.

(7) The significance of these structures is discussed.

(8) It is observed that the land velamen functions in the same way as epiphytic velamen.

### 53. Embryology of two species of Elaeocarpus.

C. Venkata Rao, Waltair.

The development and structure of the anther and male gametophyte and ovule and female gametophyte were studied in two species of *Elaeocarpus* namely *E. robustus* Roxb. and E. *ganitrus* Roxb.

The anther wall is 5-6 layered. Some of the cells of the epidermis develop into spinescent structures and others accumulate deep staining tannin contents. The sub-epidermal layer, develops into stone cells. The innermost layer develops into the secretory tapetum. The anthers open by a longitudinal terminal cleft. The microspores are arranged in a tetrahedral manner and cytokinesis occurs by furrowing. The pollen grains are small and measure 8-10 $\mu$ in diameter. They are smooth walled spherical and triporate. The intine protrudes slightly through the germ pores. They are 2-nucleate at the time of shedding.

The ovules are anatropous, bitegmic and crassinucellate with a zigzag micropyle formed by both the integuments. There is usually only one functional archesporial cell which by division forms the primary parietal cell and megaspore mother cell. Megaspore tetrads are more commonly linear and the lowest megaspore functions and forms the embryo sac of the normal type. The synergids are slightly hooked and show the two terminal vacuoles. The polar nuclei fuse before fertilisation and the antipodals degenerate early. The embryo sac expands aggressively after attaining the 8-nucleate stage and crushes all the nucellus cells above and to the sides and borders on the radially elongated deep staining epidermal cells of the inner integument. A hypostase of elongated narrow cells connects the tubular antipodal end of the sac with the vascular bundle in the chalaza.

### 54. Contribution to the Embryology of Sterculiaceae.

C. Venkata Rao, Waltair.

The development of the anther and ovule and the male and female gametophytes were studied in eleven species of Sterculiaceae namely: *Dombeya spectabilis* Bojer., *D. mastersii* Hook., *Pentapetes phoenicea* L., *Sterculia alata* L., *S. colorata* Roxb., *S. coetida* L., *Klienhovia hospita* L., *Helicteres isora* L., *Buettneria herbacea* Roxb., *Guazuma tomentosa* Kunth. and *Abroma augusta* L. Development of the embryo was studied in *Abroma augusta*, *Pentapetes phoenicea* and *Klienhovia hospita*.

The anther wall is 4-5 layered. The innermost layer develops into the secretory tapetum. Pollen grains are shed in the 2-nucleate stage and are triporate. In *Buettneria* the germ pore is situated at the summit of a tubular projection of the exine.

The ovules are anatropous, bitegmic and crassinucellate. The micropyle of the fertilisable ovule, is formed in *Dombeya*, *Sterculia*, *Pentapetes* and *Klienhovia* by both the integuments. In *Guazuma*| *Buettneria* and *Abroma*, it is formed only by the outer integument. Embryo sac develops according to the *normal*- type. The lower part of the developing embryo sac is invested by a socket of thick walled cells. The synergids in *Abroma* and *Pentapetes* show special circular receptive spots near to their micropylar ends for the entry of pollen tubes.

A single case of embryo sac with reversed polarity was noticed in *Helicteres isora*.

There is a hariy obturator in *Buettneria* and some glandular cells on the funicle below the micropyle in *Abroma*. Endosperm is nuclear to start with and becomes cellular later. Polyploid endosperm nuclei are common in the antipodal region of which the lowest is especially conspicuous in *Abroma* and *Pentapetes*.

Development of the embryo conforms to the Urtica variation of the Asterad type.

Mature seed is endospermic with a large embryo. The palisade layer of the seed coats is derived from the outer epidermis of the inner integument.

### 55. Embryological studies in Malvaceæ—I.

C. Venkata Rao, Waltair.

The organogeny, development of the male and female gametopnytes, and structure of the ovules were studied in the following members of Malvaceae namely : *Sida veronicaefolia* L., *Abutilon indicum* G. Don., *Althaea rosea* Cav., *Kydia calycina* Roxb., *Urena lobata* L., *Malvaviscus arboreus* Cav., *Pavonia zcylanica* L., *Malachra capitata* L., *Hibiscus solandra* L. Herit., *H. micranthus* L., *H. hirtus* L., *H. esculentus* L., and *Thespesia populnea* Cor.

In some species like *Sida veronicaefolia* the primary sporogenous cells of the anther function directly as the microspore mother cells while in others like *Abutilon indicum* they undergo some mitotic divisions. Microspore tetrads are usually tetrahedral, bilateral and linear tetrads occasionally. Cytokinesis is brought about by furrowing. Pollen grains are shed usually at the 2-nucleate stage, a few grains in *Kydia* being 3-nucleate. The generative nucleus is surrounded by a distinct sheath of hyaline generative cytoplasm.

The ovules are bitegmic and crassinucellate, anatropous or campylotropous. The inner integument is more massive and some layers of this accumulate tannin and starch grains. In *Gossypium* and *Thespesia* there are integumentary vascular bundles. The nucellar epidermis forms a massive epidermal cap which alone persists above the full grown embryo sac. A hypostase is formed in *Althaea* and *Thespesia.*

The archesporium of the ovule is either 1-celled or multicellular. Double and triple embryo sacs are seen in genera like *Kydia, Malvaviscus* and *Althaea.* Sometimes these are derived from two megaspores of the same tetrad as in *Kydia.* Ultimately only one sac reaches maturity. Megaspore tetrads are linear or T-shaped. Development of the embryo sac follows the normal type. The antipodals are sometimes more than three in number and some of the cells may be binucleate. They persist till the time of fertilisation. The synergids are hooked only in *Thespesia.* The polar nuclei fuse generally at the time of fertilisation. Starch grains are absent from the cytoplasm of the embryo sac except in *Thespesia.*

### 56. Embryological studies in Malvaceae—II.

C. Venkata Rao, Waltair.

Fertilisation, development of the endosperm and embryo and structure of the seed coats were studied in the following members of Malvaceae: *Sida veronicaefolia* L., *Pavonia zeylanica* L., *Malachra capitata* L., *Hibiscus solandra* L. Herit., *H. micranthus* L., and *H. hirtus* L.

The 2-nucleate pollen grains germinate quickly on the stigma. They penetrate through the transmitting tissue of the style and enter the ovules porogamously. Their entry is facilitated by an obturator which is hairy in *Hibiscus solandra* and knob-like in *Sida veronicaefolia.* They are 15-20 $\mu$ wide. The tubes persist in tact till a very late stage in the development of the embryo and seem to assist in its nutrition.

The male gametes show distinct nucleoli. Formation of primary endosperm nucleus occurs within 8-10 hours after pollination of *H. solandra* and syngamy a little later. The endosperm is nuclear to start with and becomes cellular after the cotyledon primordia are differentiated in the embryo. Ultimately the whole of the nucellus gets crushed by the endosperm which is itself scanty in the mature seed.

The fertilised egg divides without any period of rest. The development of the embryo conforms to the *Urtica*-variation of the Asterad type. The suspensor becomes large and boot shaped. The suspensor cells in *Sida veronicaefolia* remain glandular. The mature seed shows a large embryo with foliaceous cotyledons.

The outer integument remains two cells thick and forms a membraneous testa from the epidermal cells of which hairs arise in *Hibiscus* species. The inner integument increases in thickness after fertilisation and several of its median layers accumulate tannin and starch grains. In the mature seed, only its epidermal layers persist and the median parenchymatous layers get crushed.

### 57. Floral Anatomy of two species of Elaeocarpus.

C. Venkata Rao, Waltair.

The floral anatomy of *Elaeocarpus robustus* Roxb. and *E. granitrus* Roxb. was studied.

The flowers in both species show pentamerous polyphyllous valvate perianth. They are hypogynous due to the presence of a gynandrophore on which 5 antisepalous cushion shaped nectaries are present. There are

45 free stamens in two series. In *E. ganitrus* the ovary is 5-carpellary and in *E. robustus* it is tricarpellary.

At the base of the thalamus, 5 traces are given off which by division form the sepal midrib bundles and the petal marginals. Next and alternating to them are given off the conjoint petal-stamen traces. After giving off the petal midrib bundles, each trace forms by primary and secondary chorosis, 8 staminal bundles which emerge into the filaments of the antipetalous stamens. Each group is clasped by the infolded petal margins. Five traces are given off along the sepal radii which pass through the nectaries and emerge into the antisepalous group of stamens. The anthers are ciliary throughout their length. The sub-epidermal layer develops into stone cells. The stele at the base of the ovary becomes 5-angled in *E. ganitrus* and 3-angled in *E. robustus*. From each angle is given off the dorsal carpellary trace. The residual stele forms the ventral bundles which fuse above in pairs to form a common bundle which gives off the ovular traces. The bundles of each carpel again fuse and such bundle traverses along one of the lobes of the style.

The study of the floral anatomy shows that the flowers of *Elaeocarpus* resemble those of other Malvales in the origin and behaviour of the conjoint petal-stamen traces. They are pentacyclic and hence more primitive than the genera of Tiliaceae studied by the writer, namely *Corchorus* and *Triumfetta*, in which they are tetracyclic. A similar conclusion was arrived at by Kukachka and Rees (1943) on basis of anatomical studies of members of Tiliaceae and Elaeocarpaceae.

### 58. Contribution to the Embryology of Bombacaceæ.

C. Venkata Rao, Waltair.

The development of the anther and pollen, ovule and embryo sac in the following members of Bombacaceae were investigated: *Bombax malabaricum* DC., *Eriodendrom anfractuosum* DC., *Pachira rosea, P. aquatica*, *Adansonia digitata* L., and *Ochroma lagopus* Sw.

The anthers are unilocular and reniform in *Pachira* and *Adansonia*, sinuous in *Bombax* and *Eriodendron;* in *Ochroma* they are fused into a massive column. The anther wall is 5-6 layered of which the sub-epidermal layer develops into the fibrous endothecium and the innermost into tapetum secretory. In *Ochroma* the inner wall of the tapetal cells becomes strongly cutinised while in *Pachira* it gelatinises. There is a marked secondary increase in the number of microspore mother cells some of which degenerate. Microspore tetrads are tetrahedral and cytokinesis occurs by furrowing. Asymmetrical spindle is formed in the division of microspore nucleus of *Eriodendron*. Pollen grains are shed in the 2-nucleate stage. They are triangular and oblately flattened in *Pachira* and *Bombax* and spherical in the rest. In *Adansonia,* there are papillate protuberances on the exine. They are triporate in all species though a few grains in *Ochroma* are 4-porate.

The ovules are bitegmic, anatropous and crassinucellate with a zig-zag micropyle. A socket of thick walled cells is organised around the lower part of the embryo sac which hence remains much narrower than its micropylar end.

Usually there is a single archesporial cell in an ovule though two are met with in early stages. In *Adasonia,* one or more parietal cells assume characters of sporogenous cells and form tetrads, a feature in which it closely resembles Malvaceae. Megaspore tetrads are both linear and T-shaped, and the chalazalmost functions and forms the embryo sac according to the normal type. The synergids are hooked; the polar nuclei fuse before fertilisation in all but *Ochroma*. The antipodals are 3 in number and 1-nucleate and ephemeral.

Embryologically, Bombacaceae differs widely from Malvaceae and resembles Sterculiaceae and Tiliaceae in the following features; secretory type of anther tapetum; secondary increase in the sporogenous cells of the anther; triporate smooth walled pollen grains; anatropous ovules with a straight embryo sac; organisation of a socket of thick walled cells around the antipodal end of the sac; its characteristic shape; starch grains in the cytoplasm of the embryo sac and three 1-nucleate antipodals, which are ephemeral.

### 59. Morphology of the Stamens in Benincasa hispida (Thunb.) Cogn.

H. L. Chakravarty, Calcutta.

Floral morphology of the male flowers of *Benincasa hispida* is interesting. Five traces supplying three stamens in 2+2+1 proportion indicate the original number of androecium, but the two thicker stamens having a pair of traces are morphologically compound formed by cellular union of two adjacent simple stamens having a single trace in each. The odd stamen has a single trace but bears two theca a feature uncommon in most other cucurbits. This is a case of retention of normal ancestral character. The reduction of one loculus from a normal two locular stamen has taken place perhaps during slow but gradual processes of evolution through many decades.

### 60. Embryology of the genus Najas.

C. S. Venkatesh, Delhi.

Three species of *Najas* have been investigated so far, including the widespread *N. graminea*. One of these shows unilocular anthers and the others have quadrilocular anthers. The close fitting perianth of the male flowers arises as an annular growth around the anther, very much like an integument. An epidermis, a wall layer and a layer of tapetal cells surround the sporogenousmass of the anther. Septa fail to form in one of the species and the anther remains unilocular throughout. In others there is an axis and four septa. A tapetal periplasmodium is formed. Six bivalents were counted at diakinesis of the pollen mother cells in *N. graminea* collected at Jodhpur. Various types of pollen tetrads occur. Ripe pollen grains become three-celled before shedding and are densely starch-filled. They are liberated by an apical dehiscence of the anther and the falling apart of the investing perianth lips.

The ovary wall arises as an annular growth around the solitary basal ovule which is differentiated from the female flower axis. The ovule is anatropous and bitegmic. There is a single hypodermal archesporial cell in the young ovule. A linear tetrad of megaspores are formed the lowest of which develops into an eight-nucleate embryo sac of the Polygonum-type. A large undivided basal cell is present in the embryo. In one species investigated no root cap is differentiated in the embryo even in an advanced stage of the seed.

### 61. Organogenesis of the Shoot Apex in Smilax macrophylla.

G. C. Mitra, Delhi.

Cellular structure and growth of the shoot apex, the initiation of leaf and of vegetative axillary bud primordia and the differentiation of procambium in the shoot apex and in the axillary bud have been investigated according to the usual methods.

It is found that the growing point exhibits tunica and corpus zones and a third zone, the rib-meristem which differentiates from the base of the corpus. Cells of these zones differ from one another in cell and nuclear size, in staining properties, in planes of cell division, in relative thickness of the cell-wall and in relative vacuolation of the cells. The tunica consists of two layers—an outer and an inner and the plane of cell division in these cells is anti-clinal except in the region of leaf initiation in the inner tunica layer. By anticlinal divisions the tunica maintains the growth in surface of the shoot apex. The tunica encloses a central core of cells i.e., the corpus in which the planes of cell division fluctuates and result in a more or less irregularly arranged cells. There are 4-5 corpus initials in two series. The anticlinal derivatives of the outer initials of the corpus form a third layer beneath the two-layered tunica. In this layer except at the region of leaf initiation anticlinal division predominates. Irregular divisions in the corpus results in the growth in volume of the shoot apex. The basal cells of the corpus give rise to a central region of rib-meristem where divisions are predominantly transverse. The cells are rectangular and relatively more vacuolated. The derivatives of the rib-meristem form the pith cells. The pith is not well differentiated as it is traversed by procambial strands. The adult shoot apex is not zonated as has been reported in other plants.

During leaf initiation the convex free-apex becomes asymmetrical. The outer corpus layer by periclinal divisions also contributes to the basal tissue of the leaf primordium.

Vegetative axillary buds are developed by meristematic activities of a group of cells at the axillary position of the developing leaf primordium. These bud initials originate from the apical meristem by periclinal divisions in the inner tunica layer. Organogenesis of the bud apex is similar to that of the mother apex.

The differentiation of procambium in the mother apex as well as in the bud apex has been studied.

The problems relating to the growing-point, the leaf and the bud initiation and the differentiation of the procambium have been discussed.

### 62. A contribution to the embryology of Synedrella nodiflora Gaertn. and Vernonia cinera Less.

I. Banerji, Calcutta.

The sporogenous cells are one layered in *V. cinera* and two to three layered in S. *nodiflora*. Microscpore formation is of the simultaneous type. Twenty bivalent chromosomes have been observed in *S. nodiflora* and nine in *V. cinera*. The tapetum is of the plasmodial type. The pollen grains are echinate in *S. nodiflora* and lophate in *V. cinera*. They are trinucleate at the shedding stage.

The development of the embryo-sac corresponds to the 'Polygonum type'. The megaspore mother cell is hypodermal in origin. A linear tetrad of megaspores is produced of which the chelazal one functions and forms an eight nucleate embryo-sac. The antipodal cells of *S. nodiflora* become multinucleate while those of *V. cinera* sometimes become binucleate.

Fertilization is porogamous. Double fertilisation has been observed. Endosperm development is of the "Nuclear type" in *S. nodiflora* and 'Cellular' in *V. cinera.* The embryo development appears to correspond to the 'Asterad type.'

### 63. Microsporogenesis in Anisochilus eriocephalus, Benth.

J. S. Shukla, Sagar.

*Anisochilus criocephalus* belongs to the family Labiatae.

The anther shows the usual structure. There are three wall layers below the epidermis,—an endothecium, a middle layer, and the tapetum. The endothecium developes the fibrous thickenings at maturity. The middle layer degenerates very early. The tapetal cells become binucleate. The divisions of the microspore mother cells are simultaneous and both tetrahedral and isobilateral types of tetrads are formed. The cytokinesis is by furrowing. On division of the microspore nucleus a large tube cell and a small crescent-shaped generative cell are formed. The tube nucleus often assumes an oval shape and may become multi-nucleolate. The pollen grains are shed in the bi-nucleate condition and are hexacolpate.

### 64. On the formation of lysigenous lacunæ in the ground-tissue of the stem of Chamaerops humilis L.

K. N. Kaul, Lucknow.

Schoute in 1912 showed that in the ground-tissue of the palm-stems lacunae are produced schizogenously on account of the secondary growth.

In 1933-39, the author found that lacunae are always produced as indicated by Schoute, but in one case, *Chamaerops humilis* L. conditions are different. In this case the ground tissue does not split to form the lacunae schizogenously. On the contrary, the cells of the ground-tissue lying between the fibro-vascular bundles and the purely fibrous bundles enlarge to form a radiating compact tissue. This takes place first in the central parts and then proceeds towards the periphery. Round the fibro-vascular bundles and the purely fibrous bundles a single celled layer of iso-diametric cells always remains uneffected by the secondary growth and form a permanent tissue in the mature stem. The process of expansion of the remaining compact ground-tissue cells goes on account of the secondary growth till a critical stage is reached when certain specially enlarged cells in the radiating tissue begin to show disorganisation of the protoplamic contents. After sometime their cell-walls also disappear leaving circular cavities.

### 65. On the male flowers of Croton Sparsiflorus morong.

K. R. Venkatesan, Annamalainagar.

*Croton sparsiflorus* Morong is an exotic weed of South America which made its appearance in Chittagong in 1898 and has now covered practically the whole of India. Its flowers were described by various authors but the androecium of the male flower had never been correctly described. In this paper attention has been drawn to the fact that the androecium of the male flower consists of 16 stamens in 3 whorls of 5 each with the single odd one seated centrally on a pentaglandular disc. Other details are given in the fuller paper.

### 66. Development of Embryo sac and Endosperm in Specularia perfoliata A.DC.

K. Subramanyam, Bangalore.

*Specularia perfoliata* is a member of the Campanulaceae and fixed materials were sent to me from Cornell, U.S.A. The ovary is inferior, bilocular, and the indefinite number of the unitegmic ovules are borne on the axile placenta. The archesporium is differentiated in the young nucellar primordium and it directly functions as the megaspore mother cell. A linear tetrad of 4 megaspores is formed. The chalazal megaspore functions and the development of the embryo sac follows the Polygonum type. The mature embryo sac is elongated and is surrounded by an endothelium formed from the innermost layer of the integument. The synergids are beaked. Antipodals are organised as cells. Double fertilization has been observed.

Endosperm is *ab initio* cellular and its development is according to the Phyteuma type. Among the other species of *Specularia* a similar type of endosperm development is reported in *S. speculum*, *S. falcata* and *S. pentagonia*. The micropylar haustorium is two-celled; these cells gradually taper apically and have a lateral hump or bulge. The chalazal haustorium is uninucleate and bulbous. In the mature seed the cells of the endosperm contain plenty of starch grains. The epidermal layer of the seed coat develops characteristic thickenings.

### 67. The endosperm in Teramnus labialis sp.

M. Anantaswamy Rau, Bangalore.

The development of the endosperm has been studied in *Teramnus labialis*, a member of the tribe Phaseoleae of the Papilionaceae. The ovules undergo a campylotropous curvature during their development into seeds. The inner integument is completely crushed and the seed coat is formed by the outer integument alone. The endosperm is of the *ab initio* Nuclear type. The embryo sac is broad at the micropylar end and is narrowed out towards the chalaza. A large number of enlarged endosperm nuclei lying in dense cytoplasm are found at the chalazal end of the embryo sac. Cell formation in endosperm commences in the micropylar region when the embryo has reached an advanced stage in its development. The chalazal tubular portion, however, remains free nuclear and becomes coiled when the mass of endosperm tissue increases above, and by its activity brings about the disorganization of the surrounding nucellus. In later stages when the endosperm tissue fills the major portion of the seed cavity, the coiled tubular portion is in its last stages of degeneration.

### 68. Eriocaulons of the Bombay State.

Muhammad Khan, Kurla.

Members of a very small yet taxonomically important herbaceous family, Eriocaulonaceae (Eriocaulaceae) of the state of Bombay have been studied. Since the late Prof. Fyson's masterly work on the family is emperic, more or less, it was thought to study that family with a view to revise it so far this state was concerned. No new species have been evolved as an outcome of the revision. Despite this, the species have been put in genera on broad morphological differences as against that on variable characters.

The key and taxonomical views are the other points discussed in the issue under presentation.

## 67. Synopsis of the Flora of Eastern Nepal.

M. L. Banerji, Meerut.

In this paper the author, after briefly discussing the geographical and geological divisions of Nepal, gives a history of the collections so far made there. As the vegetation of Eastern Nepal is to be discussed in the paper he has defined the area. A statement of the number of species recorded by the principal collectors is given. The similarity of the vegetation of Eastern Nepal with that of Sikkim is shown on the basis of Burkill's and the author's collections. To the 28 East Himalayan species recorded by Burkill from the area, the author has added another 54 species. The paucity of West Himalayan species is shown by the presence of 13 species only.

Plants with interesting irregular distribution have not only been collected by Burkill but also by the author, and there are 9 such species. As a result of 3 collections from Eastern Nepal the author has so far described a new species of *Pimpinella,* a variety of *Hypericum hookerianum* and has made considerable additions to the list of known plants from Eastern Nepal.

## 70. Observations on the Anatomy of some of the Convolvulaceæ.

M. Sayeedud Din, Hyderabad.

(1) In all the species of *Argyreia, Ipomoea* and *Quamoclit,* vascular bundles are bicollateral.

(2) Isolated secretory cells occur in most of the species. Sabnis (1921) found them in *Breweria latifolia* Bth., *Convolvulus glomeratus* Chois and *Ipomoea sindica* Stapf. Mullan has described such elements in the case of *Ipomoea* pes-*caprae* Sweet and *Ipomoea aquatica* Forsk.

(3) In all the cases stomata are of the rubiaceous type.

(4) Calcium oxalate occurs in the form of clustered and solitary crystals.

(5) The clothing hairs consist of two cells—a stalk-cell and a terminal cell. The former is seated either on a single epidermal cell or on a collection of epidermal cells.

(6) Glandular hairs occur in some of the species. They consist of a short unicellular stalk and a flat or spherical head which is divided by vertical walls into several cells. Solereder, Sabnis, Mullan and Metcalfe and Chalk have described such hairs in several plants.

(7) An anomaly in the structure of the axis is revealed by the presence of bands of wood on the outer side of the intraxylary phloem in *Argyreia.*

### 71. Contribution to the life history of Argemone mexicana.

R. C. Sachar, Delhi.

In some flowers one or two stamens showed partial or complete transformation into carpellary tissue. The connective developed two to three spines usually present only on the surface of the ovary wall while ovules as well as mere funicular stalks on the inner surface of the transformed antherlobes. Felty stigmatic surfaces arise on the margin of the transformed stamen. In one case the ovary had also proliferated and formed an accessory structure one end of which showed several ovules borne on a swollen placenta and the other an antherlobe containing sterile pollen.

In a cross section, the anther usually shows four and occasionally three, to six microsporangia. There is fibrous endothecium, and a glandular multinucleate tapetum. About 60 per cent of microspores are small sterile. The fertile ones are nearly double the size of former. At the time of shedding the pollen grains are two celled, but many showed only a single nucleus.

The nucellus shows a hypostase and beak-like upper part. The embryo sac is of the Polygonum type. The antipedals continue to enlarge after fertilization, their nuclei become hypertrophied. They are absorbed only after the endosperm has become cellular.

Usually the pollen tubes are monosiphonous but occasionally polysiphonous. Branching pollen tubes were also seen. The endosperm is of the nuclear type but wall formation occurs later and the cells store oil. Early embryogeny shows considerable variation. Polyembryony seems to be a frequent feature, the additional embryo being derived from a synergid. The mature seed is typically dicotyledonous. The testa is formed mainly from the outer integument. The nucellus is limited to a single layer. The seedlings often show one to three cotyledonary leaves.

### 72. Embryological studies in Menispermaceæ—I. Tiliacora racemosa Coleb

R. L. N. Sastri, Waltair.

The present paper describes the structure of the ovule, the development of the male and female gametophytes, fertilisation and the development of the endosperm in *Tilliacora recemosa* Coleb. The anther wall is five layered. The tapetum is of the secretory type and is biseriate at some-places. The hypodermal wall layer becomes the fibrous endothecium. Cytokinesis is by furrowing. Pollen tetrads are bilateral or tetrahedral. The pollen grains are two nucleate at the time of shedding and triporate.

The ovary consists of nine spirally arranged carpels each with two marginal ovules of which only the upper reaches maturity while the lower degenerates early. The ovule is bitegmic, amphitropous and crassinucellate. The micropyle is formed by the inner integument alone. The single megaspore mother cell forms the linear tetrad and the embro-sac is of the Polygonum type. The antipodals are ephemeral and the synergids are pear-shaped and without hooks. The polar nuclei fuse before fertilisation. Fertilisation is porogamous. After fertilisation the ovule becomes campylotrpous due to the elongation of the funicle.

By the time of the first division of the fertilised egg, 5-6 free endosperm nuclei are formed. Wall formation in the endosperm starts from ylar end by the time the embryo becomes globular. The nucellus is ruminate. It is replaced by the endosperm in the mature seed but for a small lining layer along the integument.

### 73. Endosperm Haustoria in some Cucurbitaceae.

R. N. Chopra, Delhi.

Prominent endosperm haustoria have been observed in several genera of the Cucurbitaceae, viz., *Coccinia, Citrullus, Momordica, Luffa, Lagenaria*, *Cucumis,* and *Trichosanthes.* Whole mounts as well as microtome sections were used and several new features found.

The endosperm is of the nuclear type. While the pro-embryo is still at the quadrant stage the chalazal end of the embryo sac elongates into a coenocytic tubular process which soon becomes aggressive. It shows dense cytoplasm, several free nuclei and many oil globules, while the cells around it present a famished appearance. At the same time the upper part of the embryo sac broadens and becomes vesicular. In this the endosperm nuclei are peripherally disposed. Wall formation is initiated in the vesicular part, which gives rise to the endosperm proper. It may be simultaneous as in *Citrullus* and *Coccinia* or may progress from apex downwards as in *Momordica.*

The marginal cells of the endosperm proper often buldge out, either singly as in *Coccinia* and *Citrullus* or in groups as in *Cucumis* and *Luffa*, and their nuclei become markedly hypertrophied.

In *Cucumis, Trichosanthes, Momordica* the haustorium remains coenocytic throughout. Unstained freshly dissected material of *Trichosanthes* showed streaming movements of cytoplasm in the haustorium, which lasted from half a minute to two minutes. In *Coccinia* and *Citrullus* the haustorium at first becomes partitioned into multinucleate compartments, which later give rise .to uninucleate cells by secondary wall formation. Nuclear fusions, resulting in large irregular, polyploid masses occur in the multinucleate segments of the haustorium.

The length of the haustorium varies from 250 μ in *Citrulus* to 6317 μ in Trichosanthes, and width from 102 μ in *Citrullus* to 35 μ in *Cucumis.* It attains its maximum size and activity while the globular pro-embryo develops into a heart-shaped one. By the time the embryo is fully differentiated, the haustorium is no longer active. It shrinks and becomes coiled up. As the embryo matures, it consumes most of the reserve food in the endosperm, which finally collapses and disappears.

### 74. Petiolar anatomy of some Urticales.

R. P. Sarbhai, Kanpur.

Whereas the structure of the leaf and stem is fairly well known in most families of angiosperms, our knowledge of the petiole is very meagre. Hare (1944) and Metcalfe and Chalk (1950) have rightly emphasized the role of petiolar anatomy in the solution of morphological problems.

The structure of the petiole of some Urticales—*Ficus, Broussonetia, Artocarpus, Morus, Streblus, Maclura, Cudrania* (Moraceae); *Celtis* (Ulmaceae); and *Cannabis* (Cannabinaceae) at the base, middle region and apex has been compared.

In the basal region the first six genera show an "O" shaped arrangement of their vascular bundles. Patches of medullary phloem and occasionally medullary bundles occur in *Ficus* and *Broussonetia*. Medullary bundles are common in *Morus*. *Artocarpus* and *Streblus*. *Maclura* does not show any of these features. Vascular bundles of *Cudrania* are arranged in a flattened circle with a slight gap in the centre, while *Celtis* shows three separate bundles. *Cannabis* differs from all these in having a shallow arc with two prominent bundles, one each at the apex of the arc.

In the middle region the structure is very much alike in all the genera except for minor differences. The bundles show a "C"-shaped arrangement in *Ficus, Broussonetia, Morus, Artocarpus. Streblus* and *Maclura*, the last named genus possesses a single medullary bundle. There is a shallow crescent in *Celtis* while in *Cudrania* the crescent is incurved. .*Cannabis* shows a deep crescent.

At the apex, the bundles divide and pass into the lamina in different ways in different genera.

It appears that the petiole of *Ficus*. *Broussonetia, Morus, Artocarpus*. *Streblus* and .*Maclura* have many common features which may be considered as an indication of close affinity. *Cudrania, Celtis* and Cannabis show important differences.

### 75. Anatomical Study of the Radicle of Mustard with special reference to Vascular Differentiation.

S. C. Chakravarti, Agra.

Radicle of the resting embryo of mustard consists of a root-cap which is several layered at the extreme tip, an epidermis, 4 to 5 layers of cortical cells and a prostelar meristem in the centre with well differentiated starch sheath and pericycle. All the cells of the prostelar meristem are not alike. There exists a median row of deeply stained cells, the vessel mother cells of the future diarch xylem plate, that stretches from one end of the pericycle to the other. Vacuolation of the cells of this xylem plate begins in the middle and proceeds towards the pericycle though their order of maturation is just the reverse. The future sieve tube mother cells which are slightly smaller in diameter than the surrounding ones are placed opposite to each other next to the pericycle at an angle of 90° to the future xylem plate.

There is no vascular differentiation in the resting embryo and it begins soon after the radicle comes out of the seed coat. First vascular elements to mature in the radicle is the sieve tube which is without a companion cell. Sieve tubes on either side of the xylem plate do not mature simultaneously and so is the case with the first protoxylem elements at the two poles. More mature elements are added at the protoxylem poles earlier than at the protophloem ones.

### 76. A contribution on the development of Septate and Crystalliferous Fibres in some Indian forest trees.

S. K. Purakayastha, Dehra Dun.

The developmental study of the septate fibre in the secondary wood of *Lagerstroemia flos-reginae* Retz and *Protium serratum* (Wall ex Colebr) has been made. The former is, what the wood aratomists say, a ring porous timber and latter a diffuse porous timber. Some relation has also been observed between the septate fibre and the crystaliferous fibre in *L. flos-reginae*.

In Dehra Dun the nuclear division associated with the formation of septa in fibres appears to be confined to 6-30 to 7-30 A.M. in *L. flos-reginae* and 5 to 6 P.M. in *P. serratum*.

The septa are formed in both the species as a result of the division of the protoplast, which consists of true karyokinesis followed by cytokinesis at right angles to the fibre walls after the cells are fairly mature.

In *L. flos-reginae* formation of septa starts when the fibres are 10-20 days old and in *P. serratum* this happens when the fibres are 20-30 days old. The formation of septate fibres has been found to be centrifugal in both the species.

In *P. serratum* the nucleus divides more than once and one naturally finds many septa in the fibre; on the other hand the nucleus in *L. flos-reginae* divides only once and one septum is, therefore, the general rule.

Crystalliferous fibres are usually formed in *L. flos-reginae* once in June and again in October when the growth activities are rather slack. Some of the septate fibres near about the rays and parenchyma cells show nuclear division once again at that time. Each compartment divides into several locules and each locule develops crystal in the cytoplasm.

### 77. The morphology of the bristles in Pennisetum and Setaria.

S. Narayanaswami, Delhi.

The spikelets of *Pennisetum* and *Setaria* are always associated with a few bristles or setae at the base. Arber (1931) who investigated a few species of the two genera is of opinion that each ultimate bristle shoot is the equivalent of a spikelet but not each individual bristle as interpreted by Hofmeister (1868), Geobel (1884) and Schuman (1896). In order to adduce more evidence regarding the true morphological nature of these and other associated structures, the developmental history has been traced in both 1-spikelet and 2-spikelet fascicles of *Pennisetum typhoideum* and 6-spikelet fascicles of *Setaria italica*. The study of the two genera leads to the conclusion that the individual bristle does not prove the equivalence of a spikelet but that each ultimate bristle shoot is homologous with a spikelet. The bristle shoots may become subdivided into numerous setae but not the spikelet axis and this fact goes to show that the individual bristles are not homologous with a fertile shoot but that a lateral bristle shoot regarded as whole can be equated to a spikelet, confirming Arber's views on other species of the two genera.

### 78. Morphology of the pollen grains of the constituents of the mangrove vegetation.

T. C. N. Singh and A. T. Natarajan, Annamalainagar.

The back waters at Pichavaram command one of the finest mangrove vegetations in India. Its constituents are: (1) *Rhizophora mucronata* Lamk. (Rhizophoraceae), (2) *Sonneratia apetala* Buch-Ham. (Sonneratiaceae), (3) *Lumnitzooa racemosa* Willd. (Combretaceae), (4) *Aegiceros majus* Gaertn. (Myrsinaceae), (5) *Avicennia officinalis* Linn. (6)

*Acanthus ilicifolius* Linn. (Acanthaceae) and (7) *Excoecaria agallocha* Linn. (Euphorbiaceae). They occur on the fringes of the back waters in definite characterestic formation.

The morphology of their pollen grains was microscopically investigated under dry condition and the structural details so obtained are described in the fuller paper.

It is curious to record that except for the pollen grains of *Sonneratia apetala,* which are spherical and tricolpate, all the other species (which belong to the families of widely different phylogenetic affinities) have pollen grains in form homoplastically alike, namely they are ellipsoidal and tricolpate.

A discussion is given in the fuller paper.

### 79. Further evidence in support of Henslow's theory of the evolution of Monocotyledons from the Dicotyledons through self-adaptation to water habitat.

T. C. N. Singh and C. Lakahmanan, Annamalainagar.

The vascular bundles of the following monocotyledons and dicotyledons from the local flora were studied:

*Monocots*: *Typha angustata* Bory and Chaub., *Monochoria vaginalis* Presl., *Scirpus articulatus* Linn., *Cyperus exaltatus* Retz., *Aponogeton monostchyon* Linn., *Commelina* sp., *Eichhornia crassipes* Solms., *Ottelia alismoides* Pers., *Hydrilla verticillata* Presl. anr *Najas minor* Allioni.

*Dicots*: *Nymphaea pubescens* Willd., *Nelumbium speciosum* Willd., *Limnanthemum cristatum* Criseb., *Iussiaca repens* Linn., *Neptunia oleracea* Lour. and *Ipomoea aquatica* Forsk.

No cambium was found in any of the species noted above except for its feeble presence in *Neptunia oleracea* Lour.

The monocot species studied undoubtedly show the amphivasal type of vascular bundles. But the vascular bundles of the following dicotyledons studied exhibit the monocot type of bundles in various degrees of formations:

*Neptunia oleracea* Lour. although approximates to the dicot type of vascular bundle has hardly any cambium. A condition similar to *Neptunia* but approximating a little more to the monocot nature is exhibited by *Limnanthemum cristatum* Criseb. The vascular bundle of *Ipomoca aquatica* Forsk., offers a close resemblance to the vascular bundle of *Commelina* sp. Similarly the vascular bundles of *Nymphaea pubescens* Willd. and *Nelumbium speciosum* Willd. resemble the monocot amphivasal type of *Eichhornia crassipes* Solms. and Scirpus articulatus Linn. and *Cyperus exaltatus* Retz., respectively As far as known there is no terrestrial dicot plant whose vascular bundle resembles the monocot amphivasal type. The present study lends a stronger confirmation than ever to Henslow's Theory.

### 80. Further observation on the glandular hairs of certain flowering plants in relation to insects—II.

T. C. N. Singh and K. N. Venkatesan, Annamalainagar.

Quite a variety of insects were found to have been caught on the glandular dermal surface of *Petunia hybrida* Hort. (cultivated) and *Abutilon* sp. (wild).

The stem, leaf, pedicels, calyx and the outer surface of the corolla tube of *Petunia hybrida* Hort. and stem, leaf, pedicel and calyx of *Abutilon* sp. are rendered sticky due to the presence on the surface, of multicellular glandular hairs which secrete some sort of sticky substance.

The glandular hair in *Petunia hybrida* Hort. is composed of many elongated cells arranged end to end terminating in a capitate single, spherical or oblong cell which secretes the sticky substance. In *Abutilon* sp., however, the glandular hair has a barrel shaped base composed of flat cells, a linear neck of elongated cells and a gleboss secretive capitate head-cell.

### 81. Studies in leaf-form and venation of vascular plants—I (Apocynaceæ).

T. C. N. Singh and (Miss) Padmini Devi, Annamalainagar.

A study has been made of leaf-form and venation on similar lines as those of Dr. Ettingshausen of the following fourteen species belonging to the family Apocynaceae spread over even number of genera:

1. *Carissa spinarum* Linn.,
2. *Allamanda cathartica* Linn.,
3. *Nerium odorum* Soland.,
4. *Thevetia nerpifolia* Juss.,
5. *Cerbera odollam* Adans.,
6. *Plumeria acutifolia* Poir.,
7. *Wrightia tinctoria* R. Br.,
8. *Apocynum venetum* Linn.,
9. *Vallaris solanacea* K. Schum.,
10. *Taberaemontana coronaria* Willd.,
11. *Vinca rosea* Linn.,
12. *Rauwolfia serpentina* Benth.,
13. *Aganosma caryophyllata* G. Don.,
14. *Echites calycina* Wall.

A classification has been erected mainly on the size, shape, venation, margin and apex of the leaves and it is interesting to note that in certain respects the classification agrees with those of Benthem-Hooker and Engler-Prantl.

### 82. Studies on Palms: Part II. Anatomy of Sabal palmetto R. et S.

T. S. Mahabale and J. V. Despande, Bombay.

*Sabal* is a genus of palms now mostly restricted to New World. It has a long fossil history and hence it was thought worthwhile to reconstruct the anatomy of the plant with the help of the species available, viz. *S. palmetto*. In the large trunk of the species, the vascular bundles are spread in the cortical, dermal, subdermal and central zones and they show great tendency towards crowding and fusion in the dermal and subdermal zones. A typical fibrovascular bundle in the adult region of the central pith has a cordate cap of sclerenchyma, which is always larger than the vascular part of the bundle. A few lunate bundles with vascular and fibrous parts equally well developed are also found in the pith. The parenchymatous cells are transversely elongated and measure 150-315μ ×75μ. In the petioble the vascular bundles are mostly lunate, arranged in several series facing each other in the ground parenchyma which is made up of entirely round sells. The inflorescence is a large panicle of spadices. The vascular bundles in the region of the peduncle are also lunate and progressively condense in a large sclerenchymatous mass. There is no elongated tissue in primary or secondary axes, but it appears on the ventral side of the tertiary fruiting axes.

It will be obvious from these, that too much emphasis should not be placed only on a single character such as shape or size of the vascular bundles or the nature of the ground tissue for identifying the parts of the plant.

### 83. Studies on Palms: Part IV Cyto-analysis.

T. S. Mahabale and M. S. Chennaveeraiah, Bombay.

Palms are an ancient group of plants flourishing well now under different conditions of life. They have a long continuous history in the past without many breaks. Their phylogeny at present is mainly based on morphological considerations and accordingly the systems of classification are formulated by Martius, Bentham and Hooker, Drude and others. Attempts are now being made here to correlate them from the view point of their cytology.

The chromosome numbers in about 34 genera and 54 species are known, to which the present paper adds 4 more. The work on other unworked palms is in progress. Then number of chromosomes in *Hyphaene indica* and in *Caryota rumphiana* is 18, *Calamus rotang* has 12 and *Caryota mitis* 16. From a careful consideration of these, and analysis of the chromosomes in other palms, it appears that the majority of the species can be divided into two series, one with 16 and other with 18 n-number of chromosomes. Exceptions to these are few and are found in species of *Calamus, Chamaedorea* and *Pritchardia*. It appears therefore that the palms have evolved mainly along two series in which the basic numbers are 8, and 6. Most of the present day palms are higher derivatives from these two basic series, the lowest n-number of chromosomes among the living palms being recorded in *Nipa fruticans* as 8 and in *Chamaedorea sartorii* as 6. This is perhaps also supported by morphological evidence. Work on the female gametophytes is in progress.

### 84. Studies on palms: Part III. Anatomy of the petioles in palms.

T. S. Mahabalé and N. N. Udwadia, Bombay.

The nature of the monocotyledonous leaf and its homology with that in dicotyledons are highly controvertial. The present investigation was undertaken to study the distribution of vascular and ground tissues in the petiole of palms. The structure of the petiole was investigated in 35 species. There are two broad types of petiolar constructions in palms, depending upon the nature of the leaf : pinnate or palmate.

The study shows that in both the types of leaves the basal sheath and the middle petiolar parts are homologous, but in the pinnate type the dorsal and the ventral tissues continue expanding right upto the apex. In the palmate type on the other hand, the ventral tissues end in the so-called stipule, the dorsal ones, which are mainly vascular, extending into the lamina. Presumably these support the skin theory and phyllode nature of the monocotyledonous leaf as suggested by Arber.

### 85. A contribution to the Embryology of Prosopis spicigera Linn. and Desmanthus virgatus Willd.

V. R. Dnyansagar, Raipur.

*Prosopis spicigera* and *Desmanthus virgatus* belong to the Mimosaceae. The inflorescence in *Prosopis spicigera* is an axillary or a terminal spike of 50-60 flowers and that in *Desmanthus virgatus* is a solitary globose head of 15-20 flowers. The number of fruits formed per inflorescence is 2-4 in the former and 4-6 in the latter plant. The floral parts arise in acropetal succession and are cyclic in their arrangement.

The tapetum is of the serctory type and its cells remain uninucleate.

The archesporium in the microsprangium differentiates rather late. The microspore mother-cells produce tetrahedral tetrads of microspores after two meiotic divisions. Cytokinesis takes place by furrowing. Isobilateral tetrads are formed in the microsporangia of *Prosopis spicigera*. The pollen-grains are like those of *Prosopis glandulosa*. They are bi-cellular at the time of their shedding.

The ovules are anatropous and two integumented. The micropyle is formed by the outer integument alone. Megasporogenesis is of the normal type. The archesporium is hypodermal and single celled in *Prosopis spicigera*. Occasionally, it is bi-cellular. In *Desmanthus virgatus*, it is also hypodermal and consists of 1-3 cells out of which only one develops further. The parietal tissue becomes extensive due to the activity of the primary parietal cell and becomes covered by the epidermal cap.

The embryo-sac belongs to the 8-nucleated normal or Polygonum type. The synergids are hooked and each has a filiform apparatus. The antipodals are definite cells.

Germination of the pollen has been studied in culture. Pollen tubes are formed and the generative cell first enters the tube.

Endosperm formation follows the Nuclear type. The primary endosperm nucleus divides before the first division of the oospore. The chalazal part of the endosperm in *Prosopis spicigera* remains free nuleated even upto the stage when the cotyledons appear in the embryo and this free nucleated part is formed into a narrow tubular process which comes in intimate contact with the chalazal tissue. The development of the embryo follows the Trifolium variation Onagrad type except that a suspensor is not formed.

There is a single vascular strand in the ovule in the chalazal region prior to the first segmentation of the oospore. But afterwards, the post-chalazal extension of the strand takes place in the outer integument upto the micropyle.

### 86. Endosperm Haustoria in Roettlera hamosa (R. Br.) O. Kz. var. unifolia (Cl.) O. Kz.

Y. S. Deshmukh and A. R. Chavan, Baroda.

The paper gives an account of the method of formation of endosperm haustoria in *Roettera hamosa* var. *unifolia*. After the first three divisions of the fusion nucleus, three superimposed tiers, chalazal, middle and micropylar end formed. The chalazal chamber functions directly as the chalazal haustorium. It remains unicellular but becomes binucleate. The chalazal haustorium is the earliest to be organised. The binucleate chalazal haustorium is very large and well developed. It is very aggressive. Its shape is bluntly sagittate. The terminal tier of two cells at the micropylar end develops into micropylar haustoria. They remain uninucleate and show a tendency towards extra micropylar development.

The number of haustorial cells is three : two micropylar and one chalazal; but the chalazal haustorium is organised first and the micropylar later. The micropylar haustoria become senile first. The older micropylar haustoria show hypertrophied nuclei, but the chalazal haustorium though large does not show hypertrophied nuclei.

## ECOLOGY.

### 87. The Geographical distribution of the Halophytic plants of Bombay and Salsette Islands.

B. S. Navalkar and F. R. Bharucha.

While studying the ecology of the Mangrove vegetation from several places in and around Bombay and Salsette Islands, it is noticed that the distribution of the mangrove vegetation is chiefly composed of *Avicennia alba* which seems to be very prolific in growth and germination. Further in Bombay and Salsette Islands six stages of the different halophytic plants can be marked according to (1) the extent of nearness of the plant to see and (2) consequent richness in NaCl content of the soil. A comparison of the number of halophytes of Bombay and Salsette Islands is made with those of Sunderbuns, Malaya Peninsula and South Africa and percentage of the different species is calculated.

### 88. Seasonal variation of the water plants at Annamalainagar.

C. Lakshmanan, Annamalainagar.

The influence of different seasons on the water plants occurring in various ponds at Annamalainagar has been studied for the past two years. The plants studied may be classified under two groups.

(1) Plants which completely die down when water dries up during summer. They consist of *Nymphaea pubescens* Willd., *Ottelia alismoides* Pers., *Hydrilla verticillata* Presl., *Vallisnaria spiralis* Linn., *Lagarosiphon alternifolia* Druce., *Najas minor* Allioni, *Monochoria vaginalis* Presl., *Aponogeton monostachyon* Linn., and *Pistia stratiotes* Linn.

(2) Plants which outlive the summer. They consist of *Jussiaea repens* Linn., *Neptunia oleracea* Lour., *Ipomoea aquatica* Forsk., *Typha angustata* Bory and Chaub., *Scirpus articulatus* Linn., *Cyperus exaltatus* Retz. and *Commelina* sp.

The members of the latter group adjust themselves to the summer condition by their caespitose growth and hence they exhibit high variations in their morphological characters from season to season. Besides, during summer they bear great resemblence to xerophytic plants. The details of the morphological seasonal variations of these constituents are described in the fuller paper.

### 89. Syn-Ecology of the water plants at Annamalainagar.

C. Lakshmanan, Annamalainagar.

Succession of the constituents of ten ponds situated at Annamalainagar were studied. The ponds were demarcated into zones according to the variable depth of various regions. From periodical observations of these zones the gradual changes in plant formation of each zone were studied and recorded.

The ponds remain flooded during rainy and winter seasons. But during the summer they gradually dry up and remain such till the monsoon becomes active.

The general tendency of the plants which grow jutting above the level of water and rooted to the fringes of the ponds is to encroach the deeper regions of the pond when the water receeds during summer. These plants include *Typha angustata* Bory and Chaub., *Cyperus exaltatus* Retz., and *Scirpus articulatus* Linn. The submerged plants like *Najas minor* Allioni, *Hydrilla verticillata* Presl., *Vallisnaria spiralis* Linn., and *Ottelia alismoides* Pers., are obligately localised to deeper zones. A similar condition is met with in *Nymphaea pubescens* Willd., which forms the main floating constituent. Other amphibious floating forms like *Ipomoea aquatica* Forsk., *Neptunia oleracea* Lour , *Jussiaea repens* Linn., and *Commelina* sp. exhibit steady invasion of fresh zones during the rainy and winter seasons.

The causes affecting the progressive succession of plant constituents in the ponds are discussed in the fuller paper.

### 90. Notes on Autecology of Cassia tora L. and C. obtusifolia L.

L. P. Mall, Sagar.

*Cassia tora L* and *C. obtusifolia* L., two vicarious species with overlapping distribution have been studied with regard to their behaviour in different localities at Sagar. Their habit, habitant, reproductive capacity, growth and dispersal are described in relation to characters of Soil. It has been shown that both the plants grow better on recently disturbed soil and germination percentage and calcium content in case of *C. tora* L. are higher as compared with those of *C. obtusifolia* L.

### 91. An Ecological survey of the vegetation of Hastinapur.

Shanti Sarup and Surya Pal Singh.

Some observations on an elological survey of the flora of Hastinapur, a newly built town-ship on a historical site in Meerut District are recorded here.

The town is situated at a high level on the banks of *Burhi Ganga*, a tributory of the River Ganges.

The lands seem to have been densely forested in the remote past. Forests were cleared to use the land for cultivation.

Rains wash down the soil into the low flowing river, so the soil has been impoverished.

The vegetation at present tends towards a small xerophytic climax of *Acacia spp., Capparis aphyla, Zizyphus jujuba, Butea frondosa* etc.

Extensive planting operations are in progress. Many hardy plants like Acacias, *Prosopis. Butea frondosa* ets., are being extensively grown with a view to check the drainage and erosion of the soil and also to resist the wind effect. This might have a marked effect on the vegetation of the area.

Hastinapur at present has a vegetation consisting of a climax of partially xerophytic species and further study will be continued to record the changes effected by biotic and other factors.

### 92. The distribution of mangrove constituents in relation to pH values and physical texture of the mangrove soil.

V. R. Rajagopalan, Annamalainagar.

The linear zonations of the mangrove constituents (eight species representing seven families of distant relationships) in the back waters and lagoons of Pichavaram has been under study during the last three years. The results are detailed as under:

*Rhizophora mucronata* Lamk. (Rhizophoraceae) occurs in a gregarious pure formation where the soil is very muddy, soft and deep; the pH values being 7.3.

*Sonneratia apetala* Buch-Ham (Sonneratiaceae) with the undergrowth of *Agiceros majus* Gaertn (Myrsinaceac) exhibits an excellent formation where the soil is not muddy, but is intermixed with a medium proportion of sand having pH range of 6.3.

*Avicennia officinalis* Linn. (Verbenaceae) grows luxuriantly where the substratum is not muddy but is a trifle sandy where the pH value is 6.9.

*Bruguiera caryophylloides* Blume. (Rhizophoraceae), *Avicennia officinalis* Linn., *Acanthus ilicifolius* Linn. (Acanthaceae) *Lumnitzera racemosa* Willd. (Combretaceae) and *Excoecaria agallocha* Linn. (Euphorbiaceae) constituting a mixed formation grow best where the substratum is hard and consists of a high proportion of sand with a pH range of 7.05.

It is significant to note that the pH values did not exhibit any fluctuations during the last three years in different seasons.

From the present study it has been shown that physical texture of the soil and the pH values appear to be chief factors in the determination of the distribution of the mangrove constituents into zones or belts at the fringes of the lagoons or the back waters. Discussion is given in the fuller paper.

## CYTOLOGY AND GENETICS

### 93. Chromosome number and Secondary Association in Bacopa monnieri (Linn.) Pennell.

M. S. Chennaveeraiah, Bombay.

*Bacopa monnieri* a member of the Scrophulariaceae was previously worked out by Srinath (1934). He found 24 bivalents in the polar view of the heterotypic metaphase. From the root tip counts made in the present investigation the 2n number was found to be 68. The somatic chromosomes are very small and most of them have submedian constrictions. In some, satellites are also seen. In the heterotypic metaphase of the microsopore mother cells 34 bivalents are easily counted and this is contrary to what has been previously observed. According to the present investigation therefore the n-number is 34. Ninety-six first metaphase plates showing secondary association were studied. The maximum association is with one group of 6, two of 4, two of 3, five of 2 and 4 separate bivalents, together in 14 groups. This indicates that the basic chromosome number is not more than 14, but very probably 8, as in many other genera of the family Scrophulariaceae as stated by Wanscher (1934).

### 94. Chemical mutagenesis in the tomato.

Nirad K. Sen, Kharagpur.

An experiment on chemical mutagenesis in the tomato was undertaken at the University of California, Berkeley. Treatment of pollen in the vapor of nitrogen mustard produced haplo-lethal mutation at a higher rate than the control, as measured, by the frequency of pollen aborted $F_1$ plants. Acetic acid, ammonia, chloroform, ethyl alcohol, amyl alcohol and ether treatment did not increase mutation rate. Formalin may be a weak mutagen for the tomato.

An improved method for growing large number of tomato plants in the limited green house space has been found out which will enable the geneticists to raise several generations of tomatoes in a year.

Several of the mutants were cytogenetically analyzed, among which were two plants with isochromosomes at the diploid level replacing the normal one from the complement. One of these mutants was obtained following ammonia treatment and the other one following formalin treatment.

Several of the mutants had characteristic morphological features and their inheritance had been studied.

## PALAEOBTANY

### 95. Further observations on Palana lignites.

A. R. Rao and K. P. Vimal, Lucknow.

From a twenty feet thick coal seam at Palana in Bikaner samples of lignites were collected at a distance of every two feet in the vertical direction and their microfossil contents were studied in detail. From one of these samples, i.e., sample two, about nineteen different types of pollen and one type of probably Pteridophytic spore have already been recorded and described (Rao and Vimal, Proc. Ind. Sci. Congress, 1951; Proc. Nat. Inst. of Sciences, Calcutta, Mss.). The present paper describes in detail 20 new types of pollen which have since then been recovered by macerating fresh samples of lignites from the same block. These include one sporomorph each of *Nonaperturites, Pentaporites, Polyporites, Monocolpites, Tetracolpites, Hexacolpites, Septacolpites* and *Nonaperturites,* 4 sporomorphs of *Triporites* and 8 of *Tricolpites.* Of these *Nonaperturites, Pentaporites, Polyporites, Monocolpites, Septacolpites,* and *Nonacolpites* were not found in the previous samples. The *Trilites*, *Monoporites*, *Pentacolpites* types of pollen met with in previous samples are totally absent in the new samples. .*Triporites*, *Tricolpites*, *Tetracolpites* and *Hexacolpites* occur in both the samples. Colporites type of pollen are conspicuous by their absence in both the samples.

Among the new types described in this paper, *Nonaperturites* spm. 1. resembles the pollen of *Potamogeton*; while *Polyporites* spm. 1. resembles the pollen of *Ulmus*; *Triporites* spms. 1-3 are like the pollen of *Proteacidites*; and *Tricolpites* spm.1. is similar to the pollen of *Salix*. *Monocolpites* spm.1. can be compared with the pollen of *Nymphaea*. *Hexacolpites* spm.1. and *Septacolpites* spm.1. look like the pollen of *Nothofagus*. Types like ours resembling the pollen of *Nothofagus* and *Proteacidites* are known from the Tertiary deposits of Australia. Some of the other types of pollen occur in the Eocene beds of Green River, U.S.A. These facts confirm the Eocene age of these Palana beds.

### 96. The female dwarf shoot of Walkomiella indica, a Conifer from the Lower Gondwanas of India.

K. R. Surange and Prem Singh, Lucknow.

Seed bearing shoots showing the same epidermal characters as those of *W. indica* were obtained from the same coal from which its foliage leaves were described earlier. The fertile dwarf shoot bears several sterile scale leaves arranged in simple spiral with a single atropous, erect ovule. Perhaps the position of the ovule is lateral to the axis of the dwarf shoot and it forms a part of the same spiral as the sterile leaves. The bract in the axil of which the "flower" must have been situated is lost, because perhaps being decurrent on the axis, it was more firmly attached to it than the axis of the "flower". The scale leaves possess short hairs on the margins, are epistomatic, with papillate cells in the stomatal region. The cells of the non stomatal region are non papillate, slightly sinuous and toothed. Each stoma carries seven papillate cells. The cuticular structure of the scale leaves thus closely corresponds in general characters to that of the foliage leaves of *Walkomiella indica*.

The seed or ovule is bilaterally symmetrical, atropous, almost flat, oval and measures 2 to 2.5 mm in length, 1 to 1.5 mm in breadth. Three layers, comprising of integument, nucellus and megaspore are distinctly visible. The integument is thick and free. The nucellus is thin and free but is entirely enveloped by the integument. Its apical end is drawn out into a short micropyle. The megaspore is attached with the nucellus towards the chalazal end but is free above.

From the morphology of the dwarf shoot it appears that *Walkomiella* is a Conifer and not a Taxus. It possesses a female "flower" or a seed scale complex of essentially the same type as in *Lebachia*, one of the earliest conifers.

### 97. Palmocarpon mohgaoensis Sp. nov. A fruit from the Deccan Intertrappean series.

K. R. Surange and Uttam Prakash, Lucknow.

The petrified specimen of palm fruit described here was collected from

Mohgaon Kalan, the well known locality of the Intertrappean Series in the Chhindwara district, Madhya Pradesh.

The fruit which was embedded in a big block of chert, is a drupe of medium size, obovoid in shape, 6.5 cm. long, 2.2 cm. broad and 5.5 cm. in diameter. It is laterally compressed and possesses four ridges on the surface. The fruit was cut in thin longitudinal slices, which show that it has thin, smooth epicarp, a semi-fibrous mesocarp and a hard endocarp with a mass of matted, thick walled fibres. The fruit possesses two seeds, of which one is well developed, while the other is aborted and is pushed to one side. The fully developed seed measures 3 × 1.9 cm. in the median longitudinal plane. The pericarp is well developed at both the ends of the fruit, but thins out in the middle region where the seeds are situated. Sarocarp is composed of a loose, spongy tissue with fibrous and fibrovascular bundles. The fibrovascular bundles have radiating parenchyma round them. In the apical region of the fruit the vascular bundles are arranged in three parallel rows.

The whole organization of the fossil fruit is similar to a palm fruit. But at the same time its resemblance with a fruit of *Nipa* cannot be overlooked. Especially the characters like the apical end of the fruit, presence of ridges on the surface and two seeds of which one is aborted can very well be compared with a young fruit of *Nipa*. However, pending the discovery of more material, we have for the present included our fruit under the form genus *Palmocarpon*.

## 98. A new species of Bucklandia (B. sahnii) from the Rajmahal Hills, Bihar,

M. N. Bose, Lucknow.

This new species of *Bucklandia* has been collected from Amarjola, in the District Amrapara, Rajmahal Hills, India.

The stem is covered with persistent leaf-bases, which are very variable in shape and size. The leaf-scars show small marks of vascular bundles. As a rule there are five such marks, sometimes seven. The transverse section of the stem shows a wide central pith surrounded by a broad zone of xylem, phloem and bark with persistent leaf-bases. Cortex is well developed and fairly wide. A zone of phloem is present with thick-walled elements alternating with the thinner-walled ones. Cambium is very badly preserved; three to four layers of cells can be seen. The wood is quite compact with sharply marked growth rings. Medullary rays are most conspicuous by their number and crowded occurrence. Majority of the rays are uniseriate, but biseriate ones also occur frequently. The tracheids have mainly scalariform pitting. The early wood shows various types of pitting, varying from scalariform to multiseriate. Pits seen in the radial walls of the rays are bordered. The number of bordered pits in a cross field varies from one to six or more. Primary xylem is endarch.

The present species differs from *Bucklandia indica* in having tracheids with scalariform as well as multiseriate bordered pits. No sclariform pitting was observed in *B. indica.* Comparisons have been made with the fossil Cycadeoidean stems and *Homoxylon rajmahalense.*

### 99. Brachyphyllum spiroxylum sp. nov. from the Rajmahal Hills, Bihar.

M. N. Bose, Lucknow.

The present paper records a new species of *Brachyphyllum* (*B. spiroxylum*) collected from Amarjola in the District of Amrapara, Rajmahal Hills, India. The type specimen is a portion of silicified foliage shoot, measuring about 2.1 cm. in length and 0.4 cm. in thickness. The secondary wood differs from that in other species of the genus, by the presence of uniseriate bordered pits associated with spiral bands in the tracheids; the pits are circular and separate from each other. In this respect it shows resemblance with some of the fossil and recent members of the Taxineae. The epidermal structure of the leaves closely resembles the other European and India species of *Brachyphyllum*.

### 100. Ptilophyllum amarjolense sp. nov. from the Rajmahal Hills, Bihar.

M. N. Bose, Lucknow.

The present paper describes the epidermal characters and internal anatomy of a new species of *Ptilophyllum, P. amarjolense,* collected from Amarjola in the District of Amrapara, Rajmahal Hills, Behar. The leaves collected are all fragmentary and detached from the main stem. The anatomy of the petiole is similar to that of leaf-bases of *Bucklandia sahnii* Bose. The rachis in cross-section shows the vascular bundles arranged in a double series in the form of a "U". The leaves have a variable width, about 0.4 cm. to 4.5 cm. wide. The pinnae are mostly oblong, short and have a rounded apex, but at the apical region and in the widest fronds they are slightly falcate with acute apex. Epidermal cells on the upper side are much elongated, lower side has thin-walled sinuous cells with numerous stomata transversely orientated in the bonds between the veins. Three to four rows of elongated epidermal cells are found over each vein. The pinnae show an upper epidermis followed by hypodermis, palisade and spongy-mesophyll tissues. Vascular bundles are situated in between the mesophyll and the lower hypodermis.

The closest resemblance of the frond is with *P. cutchense* (cf.)

### 101. Notes on Flora and Vegetation of the Spiti and Chandra Valleys, NW. Himalaya.

O. A. Höeg, Lucknow.

In Chandra Valley (river bed 11-12,000, a.s.l.) many vascular species are related to or identical with European-Arctic ones. But the alpine character of the flora is less pronounced even at 14,000 than at 4,000 in S. Norway or at sea level in Spitsbergen (e.g. less self-pollination, less vegetative propagation instead of seed). The valley is uninhabited, but fuel-collecting, grazing and manuring by domesticated animals (goats) have changed the ecological conditions. In Spiti Valley excellent irrigation and manuring have produced fertile green fields near the villages, but otherwise the vegetation is mostly xerophytic. European-Arctic species are fewer.

Lichen flora rich on E. side of Hamtah pass (monsoon area), with many macrolichens (*Peltigera*, *Stereocaulon* and others). In Chandra

Valley macrolichens like *Cladonia* subgen. .*Cladina*, *Cetraria*, *Parmelia*, *Alectoria*, *Ramalina* are absent, in striking contrast to N. Europe. The intensive manuring in many places would make their growth impossible, but that is not the full explanation. *Cladonia* aff. *pyxidata* and crustaceous lichens on soil in very few places. On rocks many crustaceous species, but of macrolichens only *Gyrophora* was found near Putiruni. In Spiti lichens still more restricted, mostly on tops of boulders and therefore of ornithocoprophilous types.

Lists of species collected or observed will be published when the material has been worked out.

### 102. Williamsonia santhalensis sp. nov., a male 'flower' from the Jurassic rocks of the Rajmahal hills, with remarks on the structure of Ontheanthus polyandra Ganju.

R. V. Sitholey and M. N. Bose, Lucknow.

The new species is based on specimens collected by M. N. Bose from Sakrigalighat. The flower consists of a detached whorl of microsporophylls (about 20 in one flower) united in their lower part to form a cup-shaped structure. Situated on either side of the median line on the adaxial surface of each sporophyll there is a row of linear appendages, which occupy about half the total length of the sporophyll. The sterile distal portion of the sporophyll is expanded into an asymatrical and somewhat spathulate structure. Each appendage, believed to represent a synangium, is formed of a large number of small chambers arranged in two rows along the length of the appendage. No pollen grains have been found. In the open flower the synangial appendages stood out vertically or at some inclination from the surface of the sporophyll.

*Ontheanthus polyandra* Ganju is shown by the authors to represent a male flower of *Williamsonia*, closely resembling in structure the present species.

### 103. On some species of Ginkgoites from the Jurassic of the Rajmahal hills.

S. C. D. Sah, Lucknow.

A number of leaf impressions belonging to the genus *Ginkgoites* Seward are described from Sakrigalighat. The specimens on the basis of the shape and dissection of the lamina can be separated into different species. There are two chief types which may be new species: (1) Leaves comparatively large and divided into four cuneate segments each of which is again partially divided. (2) Leaf small and divided into four to five linear segments which may again be divided. In both cases the leaves possess a distinct and fairly long petiole.

### 104. Araucarites bindrabunensis, sp. nov., a megastrobilus from the jurassic of the Rajmahal Hills, Bihar.

Vishnu Mittre, Lucknow.

The specimen is a long and slender cone, bearing single-seeded winged scales. The scales possess a mucronate tip. Ligule unrecognizable. Seeds cylindrical and embedded in the scale but are detachable. Integument three layered, the middle layer being fibrous. The new species differs from the previously known Indian species in the shape and the structure of the seed-scale and the seed. It differs from *Ontheodendron florinii* Sahni et Rao in being compact and in bearing the seed scales at right angles to the cone axis. The three layered integument is similar to that of the seeds of *Proaraucaria mirabilis* from the Eocene of Patagonia.

### 105. The male flower of the Pentoxyleæ with remarks on the structure of the female cones of the group.

Vishnu Mittre, Lucknow. . .

The author describes some specimens which he believes to be the male flowers of the Pentoxyleae. These were borne apically on dwarf shoots closely resembling those of *Pentoxylon sahnii* Srivastava. The flower consists of filiform spirally branched microsporophylls, fused below to form a disc which surrounds a broad and conical receptacle. The unilocular sporangia are borne singly or in groups on short branches of the sporophylls. Pollen grains are monocalpate and boat-shaped. In young flower the microsporophylls are surrounded by a whorl of deciduous bracts.

The infructescence of *Carnoconites laxum* and several specimens (showing longitudinal section) of the infructescence of *C. compactum* have also been discovered. The infructescence of *C. laxum* differs from that of *C. compactum* in having much shorter pedicels and much longer female cones. The infructescence of *C. compactum* differs from its reconstruction made by Professor Sahni in the absence of bifrucation of the pedicels and in the arrangement of the cones.

### 106. Microfossils from the Jurassic of the Rajmahal Hills, Bihar.

Vishnu Mittre, Lucknow. . .

About 50 types of spores and pollen and some cuticles have been described from the Nipania chert. The spores and pollen have been classified in accordance with Naummova's system. Pteridophytic spores, cycadophytic pollen and the winged pollen of the conifers are equally represented in the microflora. Among the pteridophytic spores are some types resembling very closely the spores of modern *Schizaea*. The winged pollen grains include two-, three-, and four-winged grains. The cuticles of which there are 4-5 types probably belong to Podocarpaceae.

## PHYSIOLOGY

### 107. Relation of water retentivity to application of growth substances to cuttings of sweet potato.

A. G. Deokule and U. K. Kanitkar.

In this investigation an attempt is made to find out the effect of treatment of cuttings of sweet potato on mobility of wate within tissues. The cuttings were steeped in water and 10 p.p. IAA for 20 hours and the rate of loss of water from these after exposure to free air was compared to that from untreated cuttings stored under moist condition for 20 hours. It was found that the untreated cuttings retain water more strongly than those treated with water or 10 ppm. IAA solution.

The roots developed from these cuttings were also investigated in the same manner and the same relation was found to hold in these also. This shows that the water inside the tissues of the cuttings treated with water and IAA is more mobile as compared to that in the untreated tissues. The high mobility probably results in a quick redistribution of water facilitating rapid development of new tissues in the cuttings treated with water and Indolyl acetic acid.

### 108. Influence of Addition of straw on soil Nitrates and Yield of Wheat.

A. K. Mukerji, New Delhi.

The effect of 20 and 30 Mds. of fresh straw buried alone and in presence of 20, 40 and 60 lbs. of artificial nitrogen respectively, as well as a complete artificial mixture supplying NPK @ (40-80-40) lbs. per acre, on soil nitrates and the yield of wheat has been reported.

Straw alone, depressed soil nitrates as well as yield of wheat. Nitrogen in combination with straw, although slightly depressed the soil nitrates in the beginning and resulted in the liberation of very large amounts of nitrates in the soil at 35 days, reaching a concentration of over 3 times that in the control. The good effect of the presence of large quantities of soluble nitrogen early in the life of the wheat crop was reflected in high yields of wheat. In presence of the complete artificial the liberation of nitrates was hastened by a fortnight but the concentration was slightly less which was reflected in a slightly reduced wheat yield.

A practical possibility of using straw directly on the land as a manure by supplementing it with a suitable quantity of artificial nitrogen has been indicated by these results.

### 109. Effect of centrifuge on the dormancy of Rice grains.

B. Samantarai and A. S. Dubey, Cuttack.

Rice of variety T.812 which has normally a much longer period of dormancy, shows about 50% germination only, after a period of 3 months. After centrifuging the soaked and unsoaked grains of this variety for periods of 5, 10 and 15 minutes at the rates of 1500 and 2200 revolutions per minute, the grains were laid out for germination tests at 5 day intervals. The results show that seeds when soaked for 12 hours prior to centrifuging for 10 minutes at 1500 revolutions per minute, germinate upto 91% after 25 days whereas the controls show only 12% germination. This is only a preliminary test of using centrifuge as a method of breaking dormancy, and further work is in progress for other varieties of Rice and other seeds.

### 110. Response of Boerhaavia diffusa L. twigs to synthetic hormones.

B. Samantarai and H. Pattnaik, Cuttack.

The rooting responses of cut twigs of a dicot. plant *Boerhaavia diffusa*, having abnormal anatomical structure was studied by applying aqueous solutions of $\beta$ Indolyl Butyric Acid (I.B.A.) of different concentrations to the twigs for 24 hours. Some twigs were kept dipped in water as controls. After a few days it was observed that higher concentrations viz., 500 and 250 p.p.m. (parts per million) proved to be toxic and most of the cuttings rotted, as a result of which the number, length and weight of roots considerably went down. The optimum concentration of the hormone showing the best rooting was 100 p.p.m. The first roots emerged after 7 days of treatment with hormone of this concentration; concentration from 50 p.p.m. downward show a gradual decrease in their capacity to produce adventitious roots.

Histological studies of the cut twigs treated with 100 p.p.m. of hormone solution was made and sections were prepared at 2 day-intervals. It was noted that the cells of the pericycle regions and the cells of the phloem region are responsive and these gradually become meristematic as a result of hormone treatment ultimately producing root primordia. But other cells of the section are not stimulated at all. After reviewing work of this nature by others, the authors consider that the responsive region has probably a specific relationship with the synthetic hormone applied.

### 111. Osmotic Pressure in the isolated leaves of Ipomoea batatas treated with Indole-3-acetic acid.

B. Samantarai and S. K. Mittra, Cuttack.

The isolated leaves of *Ipomoea batatas* when treated for 24 hours with an aqueous solution of Indole-3-acetic acid with a concentration of 100 parts per million, produce good rooting after a week. The osmotic pressure of the lamina and the petiole of such leaves was determined just before and at regular intervals after treatment and it was found that the osmotic pressure of the lamina gradually increases till the fifth day after treatment and thereafter declines whereas in the petiole there is a rise till the fifth day and then a decline. The rise of osmatic pressure in the lamina is ascribed to sudden hydrolysis of the reserve material to soluble products and the corresponding rise in the petiole due to the accumulation of soluble products consequent upon translocation. The decline is maintained at the level of pretreatment value in the lamina as well as in the petiole where the decline is due to the consumption of the products in the development of root primordia.

### 112. Cambial activation in the petiole of the rooted leaves of Amaranthus gangeticus var tristis.

B. Samantarai and T. Kabi, Cuttack.

The present work is the 2nd of the series of study in petiolar anatomy of Angiosperms under the stimulation of synthetic hormones. Rooting was induced in the isolated leaves of *Ameranthus gangeticus* var *tristis* by treating them with 5 p.p.m. $\beta$-indolyl butyric acid (I.B.A.). The rooted leaves were grown in soil. Another set of leaves remaining attached to the plant served as the control. The internal structure of the petiole of the normal leaf is simple and there is very little secondary growth. In the petioles of the rooted leaves there is profuse secondary growth initiated from outside the original vascular bundles. The accessory cambium is formed in distinct arcs outside the original vascular bundles. The function of the accessory cambium is abnormal. Small, discrete groups of secondary xylem are cut inwards embedded in parenchymatous conjunctive tissue. Secondary phloem is ill developed. There is secondary growth in the primary bundles but only from the fascicular cambium and no interfascicular cambium is developed. The initiation of the cambial zone outside the vascular bundle as well as the activation of the rudimentary intrafascicular cambium whenever present is ascribed to the action of $\beta$-indolyl butyric acid in which the leaves were treated before rooting.

### 113. Rooting response of the isolated leaves of Helianthus annuus and Amaranthus gangeticus var tristis.

B. Samantarai and T. Kabi, Cuttack.

Rooting has been induced in the isolated leaves of *Helianthus annuus* and *Amaranthus gangeticus var. tristis* by the application of synthetic hormone. The hormone $\beta$-indolyl butyric acid (I.B.A.) was used. The petioles of the isolated leaves were dipped in aqueous solutions of 100, 50, 20, 10, 5, 2.5 and 0 (untreated) parts per million (p.p.m.) of the substance. In higher concentrations like 100 and 50 p.p.m. the petioles rotted from below, and the growth of the roots which were developed was not good. Lower concentrations like 5 and 10 p.p.m. favoured better rooting and the growth of the roots was also appreciable. The percentage of leaves rooted, the average number of roots per 10 leaves and the average length of the roots were noted. 10 p.p.m. I.B.A. proved to be the concentration for best rooting in the leaves of *Helianthus annuus* and 5 p.p.m. I.B.A. in the leaves of *Amaranthus gangeticus*.

### 114. Photoperiodic behaviour of medium-early varieties of rice.

Gadadhar Misra, Cuttack.

The effects of short-day photoperiod of 10 hours (8 A.M. to 6 P.M.) on the flowering behaviour of three varieties of medium-early rice, T.3 (a selection from Basamati of Dehra Dun), T.12 (a selection from Hanshraj of Unnab district) and T.21 (a selection from Chawal of Rampur State) grown in Uttar Pradesh have been studied in pot culture experiments. Short days were given for 3, 4, 5 and 6 weeks in seed bed to separate sets and in one set, after 6 weeks of short days in the seed bed, the short days were continued till ear emergence. There is a gradual delay in the time of ear emergence of the main shoots as the duration of short-day treatments are increased in the seed bed and thereafter. With 3 weeks short days in the seed bed the average delay is 0.5, 8.25 and 2.45 days respectively in the three varieties T.3, T.12 and T.21. With 6 weeks short days in the seed bed the average delay is 6.20, 12.55 and 7.15 days respectively for the same three varieties. When the short days have been prolonged after transplantation till ear emergence the delay is much more, being 21.75, 21.95 and 12.85 days respectively for the same three varieties. The photoperiodic response of the medium-early varieties is thus akin to that of early varieties and stand quite in contrast to late i.e., winter varieties where short days prolonged till ear emergence bring about considerable earliness in ear emergence.

### 115. Effect of changes in acidity on photosynthesis in Bryophyllum calycinum.

K. Kumar, Banaras.

This investigation is concerned with the diurnal changes in the acidity of *Bryophyllum calycinum*, and the measured rates of photosynthesis at different diurnal intervals marking important points in the acidification cycle of *Bryophyllum*. The values entered represent the means of three determinations.

The main results and their interpretation are summarised below.

The diurnal cycle of acidification does not conform to one pattern in Bryophyllum leaflets, namely, that there is a fall in the acidity during the day and a rise at night. The deeper green leaflets show an accumulation of acid during the night and a lower acidity in the afternoon compared to morning, but the pale green leaflets (from plants bearing them) contrary to expectation show an increase in acidity from 7-45 A.M. to 2 P.M. and evince a considerable fall at 8 P.M. This is true for the February results, but the results obtained in May show that both the pale green and the deep green leaflets fall in acidity from the morning to about 2 P.M. and then their acidity diverges in course, the pale green leaflets beginning to gain in acidity and the deeper green continuing to decrease in acidity till about 4.30 P.M. Perhaps the decrease in acidity in the deeper green leaflets is evidence of the participation of these acids in photosynthesis as partial substitutes for carbon dioxide, and most likely in the pale green leaflets such use of acids in the light intensities obtaining in February is not possible, but becomes possible in the higher light intensities of May.

### 116. Effect of electro-chemical treatment of grains on the growth characters of Wheat.

K. Kumar and K. B. Rajbhandari, Banaras.

Wheat grains of two varieties I.P.$^{52}$ and C$^{13}$ were subjected to electro-chemical treatments for 5 or 10 minutes by presteeping them in concentrations of 2.5 and 5% sodium chloride or calcium chloride for 6 hours and then passing a current at 4 volts from two Exide batteries. Treated and untreated seeds were sown separately both in the laboratory for germination counts and in the field for growth studies. The lay out was in randomized blocks and the number of replications was five.

Variety I.P.$^{52}$ treated seeds were characterised by a better start of germination than the control in all the treatments used except 5% calcium chloide electro-chemical treatment applied for 10 minutes.

Electro-chemical treatment with 5% sodium chloride for 5 minutes was productive of favourable responses in a number of growth characters in both varieties of wheat. The peak height, earliness in flowering and earlier completion of period of blossoming, a significantly greater number of ears/plant than in the control are evidenced in this treatment. A notable increase in grain yield also occurs in both the varieties. Increase in straw is, however, negligible.

### 117. Effect of sulpha-drugs on germination and early root growth of Hibiscus esculentus.

K. Kumar and K. C. Srivastava, Banaras.

In the present paper an account of the research work done on the effect of sulpha-drugs on germination and early root growth of ***Hibiscus esculentus*** is presented. The various drugs studied are sulphanilamide, sulphaguanidine, sulphathiazole, Cibazol and M.B. 693 at two concentrations 1 p.p.m. and 10 p.p.m. A statistical analysis of the data obtained reveals the following facts.

In the case of germination sulphathiazole, M.B.$_{693}$, in both the doses (1 p.p.m. and 10 p.p.m.) are effective in increasing its percentage. High concentrations (10 p.p.m.) of sulphanilamide, and sulpha-guanidine increase the germination percentage; lower concentrations of these drugs either do not influence the germination or have a tendency to retard it slightly. Maximum germination (100%) is achieved in sulphathiazole, both concentrations, Cibazol and M.B.$_{693}$, lower concentrations, and sulphaguanidine, higher concentration.

Root growth index calculated both on fresh and dry weight basis shows highest increase in sulphanilamide 10 p.p.m. and next highest in sulphaguanidine 10 p.p.m. though all the drugs used show some measure of increase.

It is suggested that the stimulative effect on germination and early root growth with such minute doses of the drugs does not appear to be of the nature of bacteriostatic action.

## 118. Effect of nutrient deficiencies and hormone treatment on growth characters in onion.

K. Kumar and K. L. Mukerji, Banaras.

The present investigation was undertaken to throw some light on the role of nitrogen, phosphorus and potassium in the synthesis of auxin in onion. Indole-3-acetic acid at a concentration of 0.3 p.p.m. on the basis of total weight of sand per pot was applied. Hoagland and Arnon's solution was used as the complete nutrient and with requisite modifications solutions lacking in N, P and K respectively were produced.

On a statistical analysis of the data obtained it is seen that the mean effect of nutrition on growth characters (fresh weight of bulb, dry weight of bulb, leaf area per plant, leaf weights per plant both wet and dry) in onion is expressed in the most marked decrease in a deficiency of nitrogen, followed by that in minus potassium, while minus phosphorus gives the least decrease. The ratio leaf area/leaf dry weight is greatest in potassium-starved plants next in nitrogen-starved ones, and least in the control plants. On the other hand the ratio leaf area/bulb dry weight is least in nitrogen-deficient plants. The ratio bulb dry weight/leaf dry weight is highest in the -N plants and least in the control plants.

Hormone application to the control plants brought about a significant reduction in the magnitude of all the growth characters excepting leaf area, but in the case of nutrient deficiencies no significant decrease was observed. The yield of bulb per plant at harvest in the plus hormone series gives no evidence of decrease, but rather of a slight increase.

From the experimental results it appears likely that the normal plant grown with complete nutrient is in no way deficient in auxin production. Any extra supply of auxin or hormone under such circumstances obviously leads to the attainment of a toxic level of hormones inside the plants thereby resulting in a decrease in growth characters. Under the nutrient deficiencies tested the plus hormone series do not show decreases in growth characters to the same extent as in the complete nutrient plants showing thereby that N, P, K deficiencies limit the auxin production in such plants.

### 119. Effect of vanadium on chemical composition of tomato fruits.

K. Kumar and S. B. Lall, Banaras.

Tomato plants of variety *Ponderosa* were raised in paraffined pots filled with pure quartz sand. Apart from the control, to which only Hoagland and Snyder's solution was added, there were three sets of treated pots in which vanadium oxide at the rates of 0.005, 0.002 and 0.01 p.p.m. was used along with the nutrient solution. Each set was replicated ten times.

The statistically analysed data show a significant increase in percentage of total nitrogen in all the treatments as compared to the control. Percentage potassium and percentage phosphorus in the fruits from treated plants also showed a significant rise over the control in the two higher concentrations, 0.002 and 0.01 p.p.m. Percentage of calcium, glucose and starch do not show a significant variation from the control in any of the treatments whereas in the highest dose used (0.01 p.p.m.) total sugar seems to increase significantly over the control. A remarkable progressive rise in vitamin C concentration with an increase in the dose of vanadium is noticed. Titratable acidity also shows a significant rise in all the vanadium treatments over the fruits from the check plants. pH shows a significant decrease in the two higher treatments of vanadium.

It appears that the nutritive value of fruits is raised in certain respects but the fruits become more sour. Records kept show that no marked variation in size of the fruits took place as a result of these treatments.

### 120. The pigments of the corolla of Brugmansia aurea Saff.

P. C. Joshi, Hoshiarpur.

*Brugmansia aurea* Saff. is a tree datura, native of warmer parts of America. The young corolla while enclosed inside the calyx-tube is of green colour. Later on it gradually turns greenish yellow, then yellow, and, finally, orange. By determining the differential solubility of its pigments in various organic solvents and by carrying out chromatographic analysis, it has been found that the young green corolla contains the typical pigments of a green leaf-the chlorophylls, xanthophyll and carotin. Afterwards the chlorophylls disappear while the carotenoids increase in amount. The mature corolla shows the presence of large amounts of carotenoids inside the epidermal cells in the form of diffused yellow pigment and numerous red needle-like crystals. The combined effect of the yellow and red results in orange colour to the corolla.

### 121. The effects of different exposures of light on the percentage germination of the seeds of Dichanthium annulatum Stapf. and Bothriochloa pertusa Willd.

S. C. Pandeya, Sagar.

Different exposures of light have been tried on the germination of the seeds of *Dichanthium annulatum* Stapf. and *Bothriochloa pertusa*

Willd. It is seen that in both the cases germination starts first in continued darkness. However, germination is much accelerated by exposures of light and the percentage germination is greatest in continuous light. In 12 hrs. of daily light, the percentage germination is increased though preliminary germination is delayed for 10 to 15 days. The seeds of *D. annulatum* Stapf. in continued darkness germinate the least and the percentage germination each day is somewhat the same. On the otherhand *B. pertusa* Willd. seeds though also germinate the least in continued darkness but the percentage germination rises gradually each day till the day after which it declines gradually.

These germination behaviour of the seeds could not be accounted as due to breaking up of the dormancy of seeds since, firstly, the seeds taken were not in dormant condition, and secondly, exposures of light had a quantitative effect on germination. No explanation has been offered for these facts and further work is in progress.

### 122. Studies in photoperiodism in relation to stomatal counts and transpiration—I.

T. C. N. Singh, Annamalainagar.

Ten-day-old seedlings of *Celosia cristata* Linn. (Amaranthaceae), *Impatiens balsamina* Linn. (Balsaminaceae), *Hibiscus esculantus* Linn. (Malvaceae), *Ipomoea batatas* Lamk. (Convolvulaceae), and *Petunia hybrida* Hort. (Solanaceae) were treated with twelve hour extra light. This treatment resulted in induction of lateness of their reproductive phase in *Impatiens balsamina* Linn., *Celosia cristata* Linn., *Hibiscus esculantus* Linn. and of earliness in *Petunia hybrida* Hort and inhibition of tuber formation in *Ipomoea batatas* Lamk.

During this period studies in the epidermal peels of the upper and lower surfaces of leaves of the aforementioned species, have revealed that the number of stomata per unit area was much higher in photoperiod plants than the control.

Subsequently observations were also made on transpiration of *Impatiens balsamina* Linn. and *Petunia hybrida* Hort. with the aid of Shah's transpiroscope. It was found that the relative transpiration values of each of the species were not less than 75% higher in the photoperiod plants than the control even under identical conditions of the day light.

Thus, therefore, there appears to be a correlation between photoperiodism and higher transpiration as a result of increased number of stomata.

### 123. On the effect of sound on protoplasmic streaming in the cells of Hydrilla verticillata Presl.

T. C. N. Singh and (Miss) Stella Ponniar, Annamalainagar.

Experiments have been in progress since December 1950 on the effect of sound on the protoplasmic streaming in the cells of the leaf of *Hydrilla verticillata* Presl.

During early hours of the mornings (7 A.M. to 8 A.m.) and late in the evenings after 6 P.M., when the streaming of protoplasm is almost at zero point, it may be excited into a normal movement of streaming by sounding a tuning fork for 10 to 15 minutes. The highest degree of streaming movement may be excited by continuing the sounding for a total continuous period of about 30 minutes.

When the leaves are covered with cover glass, the transmission of excitation takes longer time than without cover glass.

Of all the excitations induced by musical instruments, the sound produced by Violin was found to be the most effective in exciting the protoplasm of the cells of *Hydrilla verticillata* Presl. into streaming movement in the shortest period of time.

# 40th INDIAN SCIENCE CONGRESS, LUCKNOW, 1953

## SECTION OF STATISTICS

PRESIDENT : DR. H. C. SINHA, M.Sc., Ph.D., F.S.S.

## *Abstracts*

### 1. Application of the Measure of Skewness to determine the Heights of the Horizons where the unfettered growth of a pruned tea bush attains Dormancy for the first and second time.

S. C. BARUA, Tocklai (Assam)

It is not often that a statistic like Pearson's measure of skewness comes of use in the solution of practical problems connected with crop. Its application in the search for an indicator of the optimum height of the plucking surface above the pruning level of a tea bush is illustrated in this paper.

The tea bush is annually pruned flat, the shoots thus regenerated being tipped and plucked at a constant "initial height" above the pruning level. The different kinds of tea respond to this "initial height" differentially in terms of crop.

The possibility of finding an indicator of the optimum "initial height" was studied. For this purpose the lengths of the stems marked off by the end of the first two successive "growth intervals' that a tea bush passes through within a season, were examined. By hypothesis the desideratum is the mode and not the mean of these heights, since the maximum number of shoots should be tipped at the right level to get the most of the crop by regeneration. Pearsen's measure of skewness was applied to the data which presented a skew distribution. The indicator values 6″.2 and 12″.9 compared favourably with actual optimums which were 6″ and 12″ respectively.

### 2. An Example where the Maximum Likelihood Estimator does not possess the least asymptotic variance.

D. BASU, Calcutta.

In the case of a rectangular population with range $\theta$ to $2\theta$ the maximum likelihood estimator $\frac{1}{2}\xi$ of the unknown parameter $\theta$ is shown to be only 80% efficient compared to the alternative estimator $1/5\ (2\xi + \eta)$ where $\xi$ and $\eta$ are respectively the maximum and minimum sample observations.

### 3. Cycle of late Monsoon Rainfall in Meerut District.

A. P. BHATTACHARYA, Roorkee.

An attempt has been made to determine the existence of cycle, if any, of late monsoon rainfall in the district of Meerut, U.P. It is well known that late monsoon rainfall for the months of September and October plays a great part in determining the quantity of total irrigated area for late paddy (among kharif crops) and wheat, barley, bajra, grams, pulses (among rabi crops), as also double cropped area crops such as sugarcane, tobacco, etc. It was possible to predict with some confidence whether irrigation for the above mentioned crops was going to be above or below the average from the determination of such a cycle for late monsoon rainfall. Data for the years 1905 to 1950 have been analysed by the methods of studying Time Series. It was found that the period of oscillations of late monsoon rainfall for Meerut District might be taken to be 4 years.

### 4. Statistical Analysis of Discharges of the Ganga river at Hardwar and Narora.

A. P. Bhattacharya, Roorkee.

The Ganga river in U.P. has two gauging stations, Hardwar and Narora. An attempt has been made to determine the time lags for different ranges of discharges at the upper site, namely Hardwar, to be recorded at the lower site, Narora. This has been done to facilitate improvement in the regulation of supplies in the two canal systems taking off from Hardwar and Narora. It was found that a lag of 3 days is required for discharges up to 20,000 cusecs and 2 days for those above 20,000 and below 50,000 cusecs, while it is 1 day above 50,000 cusecs. A lag of two and three days is required for summer and winter freshets respectively.

### 5. A possible use of Certain Measurements in Control by Gauging.

B. C. Bhattacharjya, Calcutta.

Assuming that the population of manufactured products is normal, let it be divided into three sections A, B, C by the quartiles. Let a, b, c be the numbers of observations falling in the respective sections, out of a sample of $n$. Two 'indicators' $X=\sum_{C} x+\sum_{A} x-(c-a)x_1$ and $y=\sum_{C} x-\sum_{A} x-(c+a)x_1$ where $x_1$ is the semi-interquartile range, have been formed in imitation of Steven's indicators $c-a$ and $c+a$; and it has been discussed how they can be used —it is believed with better precision to detect changes of the mean and the S.D of the population of manufactured products. The need for measurement and calculation is sought to be minimised by certain restrictions of the use of $X$ and $Y$.

### 6. On Independence of the Distributions of a system of Canonical Correlations.

I. M. Chakravarti, Calcutta.

Let $S_i$: $(p \times p)$, $i=1, 2, .. k$, be distributed independently in Wishart's form with $n_i$ $(i=1, 2 .. k)$ degrees of freedom and same parameter matrix $\Lambda$. Denote the roots of the determinantal equations

$$\left| \sum_{j=1} S_j - \lambda_r \sum_{j'=1} S_j' \right| = 0$$

by $$\underset{\sim}{\lambda_r} = (\lambda_{r1}, \ \ldots \ \lambda_{rp}) \quad r = 1, 2, .., k-1$$

and $$S(k) = \sum_{j=1} S_j$$

Then $S(k)$, $\lambda_1 \ldots \lambda_{k-1}$ are independently distributed.

### 7. On a relation between Canonical Correlations and Partial Canonical Correlations.

I. M. CHAKRAVARTI, Calcutta

With three sets of variates $x_1 \,..\, x_p;\ x_{p+1} \,..\, x_{p+q};\ x_{p+q+1} \,..\, x_{p+q+r}$ following multivariate normal distributions, it has been shown that between the Canonical Correlations of $p$-set with $q+r$-set and those of $p$-set with $q$-set when $r$-set is kept fixed, there exists a corresponding relation as between multiple and partial correlations.

### 8. On Recursion Formulae, Tables and Bessel Function Populations associated with the distribution of Classical $D^2$-Statistics.

S. C. CHOWDHURY, Calcutta.

This paper, being a continuation of an earlier work published in Sankhya, Vol. 8, Part 3' 1947 by Dr. P. K. Bose, Calcutta University, discusses (a) the construction of an unbiased and most powerful critical region based on the classical $D^2$-statistic and (b) the determination of the relative confidence interval.

### 9. On Deseasonalising Time Series Data.

A. C. DAS, Calcutta.

Assuming the observed time-series data to be the sum of a polynomial trend, a seasonal and irregularity, it has been proved that the necessary and sufficient condition for deseasonalising the data by taking the moving average of length equal to the period of the seasonal is that the trend will be a polynomial of degree less than three.

### 10. Statistical Investigation leading to the establishment of a 'Quality Complex' from the Tea Taster's reports and its relation to the Growth of a Tea plant.

K. N. DUTTA, Assam.

The Taster's reports on the cup characters of a large number of individual tea samples were studied and a "Quality Complex" designated as Intrinsic Quality ($Q_I$) is established from the various attributes such as Quality, Briskness and Strength. This intrinsic Quality would probably be an improved expression of the Taster's opinion on the sample.

Intrinsic Quality is related to the density of hairs on the lower surface of the leaf.

The Growth of the plant has a linear regression on the size of the leaf from which the plants were raised.

Intrinsic Quality is parabolic function of seed size. When this function is resolved into factors, one of its factors becomes indentical with the Growth function, when only a certain constant is added to it.

It may be deduced from the study that

(i) Growth increases with seed size

(ii) Rate of change of Quality per unit of Growth decreases as the size of the seed from which the plants were raised, increases.

### 11. On the use of Relaxation Method for solving Certain Hydrodynamical problems.

M. GANGULI, Poona.

In this paper the author has used the Relaxation Method for solving certain problems on potential flow and also for evaluating the field of flow for overflow spill ways.

## 12. On a Prediction Problem in Time Series.

A. K. Gayen and G. C. Roy, Calcutta.

This study considers a time series of 606 daily maximum of certain economic observation. The diagrams obtained by joining successive points of scatter of unit lag, are found to indicate probable turning points which suggest possibility of extrapolation to a limited range. Periods as obtained from correlation function and spectral function built up of autocorrelations have been taken for a comparative analysis with those obtained otherwise.

## 13. Investigation into the Accuracy of Family Budget data with special reference to period of recall.

A. Ghosh, Calcutta.

The object of this paper is to devise methods of assessing the reliability of family budget data obtained by interview methods with different periods of recall and to suggest checks and correction factors for improving the same.

## 14. On an extension of Geary's Theorem.

R. G. Laha, Calcutta.

The following theorem has been proved as an extension of Geary's Theorem:-

Let $x_1, x_2 \ldots x_n$ be identically distributed independent random variables. If now the sum $x_1 + x_2 + \ldots + x_n$ is distributed independently of any quadratic form

$\sum_{i,j=1}^{n} a_{ij} x_i x_j = \underset{\sim}{x} A \underset{\sim}{x}'$ satisfying the relations (i) $\underset{\sim}{\varepsilon} A \underset{\sim}{\varepsilon}' = 0$, (ii) $\sum_{1}^{n} a_{ii} \neq 0$

where $A$ is the matrix of the quadratic form, $\underset{\sim}{\varepsilon}$ the vector (1, 1, 1 .. 1) and $\underset{\sim}{x}$ the vector $(x_1, x_2 \ldots x_n)$, then the distribution of each $x_i$ should be normal.

## 15. On Some Problems in Canonical Correlations.

R. G. Laha, Calcutta.

It has been shown that the addition of some extra variates to the larger of the two sets of variates will increase the sum of squares of the canonical correlations between these two sets, and further that this increment is zero when and only when all the partial canonical correlations between the smaller set and the set of extra variates, after eliminating the effect of the larger set vanish. This fact leads to an interesting conclusion that the hypothesis of zero increment in the canonical correlations can be easily tested from the distribution of partial canonical correlations which is already known.

## 16. A note on Minimum Variance in Unbiased Estimation.

S. K. Mitra, Calcutta.

In this paper a useful technique by Hammersly (J. R. S. S., Series B 1950) is *applied to investigate the lower limit of variance* attainable by unbiased estimators *ually two classes of problems: (A) Non-regular estimation of the continuous type Cramer—Rao limit is not calculable; (B) Regular estimation of the con-*

tinuous type, where the Cramer—Rao limit can be computed but is not attained for the best unbiased estimate.

In case (B), under certain broad regularity assumptions, a sufficient condition is stated under which Hammersly's technique improves the situations.

In case (A), however, though the actual limit determined is not very satisfactory, it is important in as much as it gives a valuable indication of the large sample order of variances attainable by unbiased estimators in such cases.

Lastly, an improvement of Hammersly's technique is also suggested.

## 17. Design and Analysis of Triangular Singly Linked Blocks.

K. R. Nair, Dehra Dun.

Triangular singly linked blocks form a sub-group of the general class of partially balanced incomplete block designs. The number of treatments involved in this sub-group of designs is $\frac{1}{2}\,p(p-1)$. The experiment can be conducted in blocks of $(p-1)$ plots or experimental units and requires only as few as two replications of each treatment. If sufficient experimental material is available the design can be repeated several times so that the number of replications of each treatment remains an even number. In this paper, three methods of constructing the design are described. Simplified formulae which minimise the computational work involved in the analysis of this experimental design have been derived.

## 18. On the use of Probit Technique and Response Time relationships in the study of Optimum Conditions for transport of Larvae.

R. G. Narasimhan, Calcutta.

One of the major problems to be faced in the transport of larvae over long distances is to prevent the growth of bacteria in the medium of transport. The bacteria utilise the available oxygen in the medium at an alarmingly rapid rate leaving very little oxygen for the larvae to survive. Since any disinfectant employed to prevent the bacterial growth may have a lethal effect on the larvae as well, the least harmful among the available disinfectants has to be chosen for the purpose. This paper discusses the use of probit technique in such situations with an illustrative example.

Another important problem over long distance transport is to choose the optimum surface area and depth of the transporting medium. The use of the study of response time relationships for such cases has also been studied with an illustration.

## 19. A Problem in Least Squares.

C. R. Rao, Calcutta.

The distribution of the ratio

$$U = \frac{\min\limits_{\tau} \sum\limits_{1} (y_i - a_{i1}\tau_1 - \,.\,.)^2}{\min\limits_{\tau} \sum\limits^{q+r} (y_i - a_{i1}\,\tau_1 - \,.\,.)^2}$$

where $y_1, y_2$ .. are independently normally distributed and $E\,(y_i) = a_{i1}\,\tau_1 + a_{i2}\tau_2 ..$ has been obtained and *its use in tests of significance of specification has* been indicated.

## 20. Some results useful in Analysis of Dispersion.

J. Roy, Calcutta.

In this paper Fisher-Cochran's theorem on Chi-squares is extended to Wishart's distribution. This leads to a generalisation of some of Rao's theorems on Least Squares to multivariate linear estimation by the principle of "minimum dispersion". Necessary and sufficient conditions are obtained (1) for sums of mutual products to be distributed in Wishart's form and (2) for independence of two Wishart's distributions. Some properties of Wilks' $\Lambda$ criterion are discussed. A test of independence of two sets of normal variates when a third set is fixed is obtained. The results are useful in analysis of dispersion.

## 21. Estimation of the Rate of Natural Growth of Population for West Bengal.

A. C. NAG, Calcutta.

In this paper an attempt has been made to estimate the rate of natural growth of population in West Bengal by some sampling method. The results obtained by using fertility rates derived from the sample in conjunction with an Abridged Mortality Table prepared from the 1951 census figures for West Bengal and the death records of the city of Calcutta for the same year, appear to show that the decennial rate of natural increase would be in the neighbourhood of 12 per cent if in future the existing fertility and mortality rates do not materially change.

## 22. Sampling from a Finite Population.

M. V. JAMBUNATHAN, Mysore.

A simple method of deriving the variances of statistics for samples from a finite population, adopted in this paper, leads to the evaluation of relative efficiences of several standard sampling designs. The technique is also applictable in cases of attributes.

## 23. Least Square Estimate under Linear Constraints.

M. V. JAMBUNATHAN, Mysore.

Assuming normal distribution for the dependent variable, it is shown in the paper that the hypotheses contained in the constraints in the problem of Linear Estimation can be tested by using the F-test.

## 24. A note on the Unreduced Balanced Incomlpete Block Designs.

P. M. ROY, Calcutta.

This paper deals with the unreduced balanced designs, the object being to investigate (i) what are the unreduced designs, (ii) whether there is any connection between these designs and finite geometries, (iii) how the theorems of the method of differences are connected with these designs, and (iv) whether there are unreduced designs which are capable of presentation in resolvable and affine resolvable form. Necessary conditions under which the finite geometries as well as the theorems of the method of differences might be applicable have been discussed and the limits within which $\lambda$ must lie for all the 'reduced' and 'unreduced' designs have been derived. The main results obtained are: (i) b. i. b. designs for which $k=2$, $v=2$ and $v=1$, and the designs with parameters $v=8$ and $k=3$ or 5 are the unreduced designs. Other b. i. b. designs are parametrically reduced ones. (ii) Complementary design is reduced or unreduced according as the original one is reduced or unreduced. (iii) All the unreduced b. i. b. designs with even v and $k=2$ are resolvable. (iv) Whenever a balanced design, no matter resolvable or not, has parameters in the form $v=nk$, $b=nr$, r, k, $\lambda$, n being an integer, the complementary design can never be resolvable unless the design is self-complementary and k is even.

# 40th INDIAN SCIENCE CONGRESS, LUCKNOW, 1953

## SECTION OF PSYCHOLOGY & EDUCATIONAL SCIENCE

PRESIDENT: PROF. JAMUNA PRASAD, M.A.

## *Abstracts*

### 1. Stereotypes and Newspaper.

PREM KANTA, Lucknow.

This study deals with propaganda as shown in the effects of emotional stereotypes on Newspaper readers. The likes and dislikes of University students are checked on a scale desired for this purpose and the effect of emotional stereotypes festered by newspapers, the group are estimated.

### 2. Personality prototypes: A study of Interrelated Patterns of personality and Culture.

KAMINI SAHANI, Lucknow.

The general purpose of the study is an enquiry into the interrelation between personality and community as reflected in the existing personality prototypes. A prototype is defined as an ideal pattern of the kind of person which the individual would like to be or become. The results indicate a marked difference between the prototypes of the Hindu and the Muslim students on whom this study was conducted. The specific content of the Hindu prototype reveals attitude-value systems which stress humility, respect for tradition, and authority, moderation, intellectual and religious discipline and honesty. Economic values, social prestige and power are conspicous by their absence. In the Muslim prototype the emphasis is more on social responsibility, action, and consideration for the oppressed.

This is a preliminary and exploratory study. The results are qualitative, limited to few samples and tentative. They need to be supplemented by extensive experimental research.

### 3. A study of the Self-concept and Attitudes of University Students.

SUDARSHAN PAL, Lucknow.

A part of Sack's Sentence completion test has been used to study the attitudes of the university students towards their parents, sex and self.

The paper presents a brief summary of the important work on the Sentence Completion Test as a projective technique. The results of the present investigation are given. Weighted scoring has been used to measure the intensity of affect. Group differences in the attitudes of the groups employed are also indicated.

### 4. An experimental study with the Thematic Apperception Test.

KAMLA SRIVASTAVA, Lucknow.

The need for modifying the original Thematic Apperception test has been generally felt to suit the test for varying socio-cultural conditions.

The paper reports the results of a preliminary experiment with a parallel form of the Thematic Apperception Test devised for use with Indian adults females. The results obtained are compared with those found on the original Thematic Apperception Test of Murray and Morgan on the same subjects.

### 5. Content-Analysis of some Lullabys, Childrens' stories, Fairy Tales and Mythological Stories

AZIR-UN-NISA NAHEED, Lucknow.

The paper reports the most-frequently used lullabys, childrens' stories, fairy stories and mythological stories. A content-anyalsis of the material collected is conducted. An attempt has been made to assess the influence of those on the personality development of children.

### 6. Towards the construction of a picture frustration test.

S. P. SRIVASTAVA, Lucknow.

From a preliminary study of the situations frustrating the grown-ups an attempt has been made to devise a P–F test for use with male adults. The paper also reports the types of group difference as determined by the nature and direction of aggression.

### 7. An experimental study of aggression in children with doll play.

HEMA PANDE, Lucknow.

The paper reports the conclusions of an experiment on children between 3 and 5 years regarding the sequence and type of aggressive behavior after Sears. The experiment is intended to test his conclusions in a different cultural milieu.

### 8. The use of future autobiographies for studying group differences.

L. P. KULSRESHTA, Lucknow.

Future Autobiography (F A) has been used as projective technique in clinical diagnosis. The present investigation attempts to study group differences with the help of the F. As. The F.As. collected from the experimental groups are analysed in terms of 'nature of content', 'level of aspiration', 'reality', 'orientation', 'structurization of future', 'anxieties', 'frustractions', and 'attitude towards self and others'.

Significant differences seem to emerge specially in areas of 'reality orientation' and 'level of aspiration' between the groups studied. F.A. promises to be a useeful instrument of social research.

### 9. A Test of Emotional Maturity.

DR. S. M. MOHSIN, Patna.

A paper-and-pencil device for measuring emotional maturity has been proposed. It was tried on 100 college students

The split-half reliability of the measure is .84 uncorrected, and .91 corrected by the Spearman-Brown Formula. Its correlation with a standard test of intelligence is .86. This lack of correlation proves the non-intellectural character of the factor underlying the test responses.

To examine the validity of the test, a paper-and-pencil test of projection was used on the assumption that the less emotionally mature a person is, the more liable he is to be affected by the tendency to projection taken in the strict Freudian sense. The results show consistent trends supporting this assumption.

## 10. Research Patterns of two groups of Schizophrenia.

PRAMOD KUMAR *and* MRS. MYRA KUMAR, Ranchi.

Different mental disorders present different patterns in their Rorschach records by which they can be distinguished from one another. The present paper is a study of the Indian patients on the same lines. All the cases studied (25 Catatonic and 25 Paranoid Schizophrenics) were the indoor patients of the Hospital for Mental Diseases, Ranchi. Rapaports technique was followed. The results obtained were in agreement with those of Rorschach and Rapaport in the essentials. The Catatonic group gave low $R$ high $W\%$ (mostly vague and arbitrary); low $F\%$ and equally low new -$F\%$ with absence of $M$ and predominance of c and *cf* over $Fc$ or 100%$F$; very low $F+\%$; high percentage of vague and arbitrary forms; deviant verbalisations like queer, absurd, etc., and marked perservertion while the Paranoid Schizophrenics gave low $R$ with high $W$ % (of averagely good quality) or high $R$ with low $W$ % and high $Dr$ %; over emphasised $S$ high new -$F$ % with many $M$; $Fc$, of and c equally prominent high $F+\%$; low per centage of vague and arbitrary forms and numerous anatomical responses.

## 11. Teaching of Psychology & Research.

L. J. BHATT, Baroda.

1. A combination of the unique and the familiar makes every research problem interesting; thus the training in research should go beyond the production of a generation of technicians of science.

2. Significant and effective research must have four aspects; Philosophy, Strategy and Techniques.

*Philosophy* is the thought, imagination and discussion which lead the research worker to determine which problems are fundamental; the *Strategy* is the long-term organization of series of researches to establish a new body of knowledge concerning some fundamental problems; the *Tactics* are the manoeuvering necessary to obtain the data, the *Techniques* are the detailed procedures for obtaning and interpreting the data of the problem.

3. Scientific research in general is moving from the era of the individual explorer to the era of planned collective expedition. In Psychology, insolationism should be regarded as badly dated in intellectual discovery as in politics.

4. Research must arise from vital educational or social questions, about the actual facts, and needs. As we have a small army of workers in this field, the research should naturally be utilitarian.

## 12. A study of Provincial Stereotypes of Two Different Groups.

V. K. Kothurkar, Poona.

The following study was undertaken in the hope of ascertaining some facts as to what adjectives, the two rather dissimilar groups of University students and housewives, use in characterizing certain provincial social groups. The two groups were selected for their divergence. It was presumed that, on social matters, the group of housewives with their limited social experience, would characterize other social groups differently from the University students with their wider social contacts.

This presumption, however, has not been borne out by the results of this study. From the Tables of Results, it will be seen that so far as the five most commonly used adjectives are concerned, the two groups apply the same adjectives with practically the same frequencies. This confirms the very wide prevalence of these social images.

There is a distinct tendency to enumerate more frequently the undesirable characteristics with respect to other social groups. The general preponderance of undesirable trait names indicates the prejudiced character of social thinking.

It is also concluded that provincial exclusiveness and the in-group tendencies in general, are apparently on the increase.

## 13. Estimates of Objective and Subjective Qualities by the Ranking Method.

S. Jalota, Banaras.

This paper reports upon the intra-group rankings by 12 judges for post-graduate students, for the traits of *Height*, an objective quality, and Scholastic Ability, a relatively subjective quality. The Average *range* of rank-differences for the objective quality was 7.8, and for the subjective quality it was 11.6.

It shows that all estimations of *ranks* are largely subjective, and there is the possibility of wide discrepancies even in the case of obvious objective qualities like *height* in a familiar and primary (face-to-face) group. This is an argument for more objective measurements, like standardized tests of mental ability.

## 14. The Problem of Dream in Ancient Indian Psychology.

Anadi Hazari, Muzaffarpur.

The ancient Indian psychologists recognised four states of consciousness; i.e., the state of wakefulness, the state of dreams, the state of deep sleep and the state of pure self-consciousness. While awake, the soul is conscious only of external objects and enjoys the gross things; while dreaming it is conscious of internal objects and enjoys the subtle things; while asleep, it cherishes no desires and is centred in itself; in the fourth state it is conscious of itself only.

The state of dream is quite separate from other states of consciousness. In this state, the Soul enjoys freedom of will; it moves wherever it likes, and creates manifold forms for himself, rejoices with women and sees terible sights. The Soil is highly active and creative in this state; it experiences greatness in its creation and enjoyment. It sees, hears, and enjoys all which it has or has not experienced in the state of wakefulness. Like Freud, these psychologists refer dreams to the past although not to to the remote past and emphasise its wishfulfilment aspect. They say that the Soul remaining unsatisfied with its creation and enjoyment in the waking state, creates all sorts of fantastic objects and persons for its enjoyment in the state of dream. They do not maintain that only sexual desires are fulfilled in dreams. Like Adler they maintain that the Soul cherishes a desire for greatness. While awake, this desire is not well fulfilled, but it is fulfilled in the fantastic creation of the Soul in this state of dreame.

## 15. Psychology of Manic depressive psychosis.

### N. N. CHATTERJI, Calcutta.

In depression four symptoms are usually noticed viz. depressive emotion, difficulty in thinking, lack of motor agility and self reproaches with suicidal tendency. Manic symptoms which comes alternately with it are exactly the opposite. Abraham and Freud have given emphasis on the fixation on oral aggressive phase of the libido development and have shown that depressive emotion arises from the loss of loved object due to its being orally incorporated and self reproaches and suicidal tendency from the sadium directed towards the incorporated object. Manic symptoms appear from the same aggressive-ness. From the analysis of a depressive patient I have shown that depression appears from the oral incorporation of both father and mother images and the necessity of this oral incorporation arises for solving the oedipus conflict. The patient feels the desire of going into the mother's womb to protect himself from the castrating father and this is responsible for the inhibition of his mescular and mental energy. The desire of going into the mother's womb takes the form of being devoured by the mother. He also wants to eat his father up for killing him and absorbing his power but the internalised father inhibits his sex and depressive emotion arises from this loss of masculinity and the loss of mother as a genital object. Manic patients' flight of ideas represents the act of exteriorisation of the internalised father image, euphoria, the joy of his success and motor agility, his freedom from his father's control.

## 16. A new test for the Study of the Phenomenon of 'Preconceived Notion'.

### K. ROY CHOWDHURY, Aligarh.

The paper reports the preparation of a new test by the author for the study of 'preconceived notice', and the results obtained so far by the use of this test. The present study is not to be confused with that of effects of retro-active inhibition or illusion. The purpose here is to study the conditions in which a notion received from stimuli words incorporated in short narrations and arousing socio-cultural ideas, can be precipated into or projected upon words which are introduced in somewhat similar narrations given later to the subjects.

Zigler's technique of experimentation which physical objects has been employed with suitable modifications, so that for the "core" and "context" perceptions short narrations (in form of simple stories) presenting stimuli words replace physical objects. Changes in reproductions related to time facts have been noted, and both qualitative quantitative analysis have been attempted. Interesting results have been obtained throwing light upon the nature of the formation of pre-conceived notions.

## 17. Effect of language on value preferences

### M. N. KAMALA, Mysore.

An experiment was devised to find out the effect of language on Value Preferences. The test material consists of 3 lists of Values in English, of which one contains Universal

Values, and the third consists of undersirable Values. These 3 lists were translated into Kannada, the regional language and an attempt was made to compare the consistency of preferences in the two languages, English and Kannada, with regard to Universal, Personal Values and consistency between likes and dislikes. The results showed that English language shows better consistency of preferences than the regional language in spite of the familiarity of the latter and also that the Universsal-personal Values Scheme was not apprehended by this group. It was nevertheless confirmed that liking for a quality and dislike for its opposite quality go hand in hand.

## 18. Mechanism underlying thirst and drinking behaviour.

AWADH KISHORE PRASAD SINHA, Patna.

The term "Thirst" has been commonly used in three different senses: (a) a physiological state that may be easily defined as a negative water load, (b) a sensation, (c) an urge or craving for water, and different theories have been advanced holding one or the other meaning of the term. In this paper, the writer, after examining the various theories of thirst, has been led to conclude that the different theories of thirst offer only a partial explanation of the neutral mechanism underlying thirst and drinking behavious. The details of the mechanism, therefore, need to be worked out. And in this, the writer is in agreement with Marquis that thirst should be regarded as a drive and that the total mechanism includes: (a) need (lack of water), (b) cue (dryness of throat), (c) variability of behaviours, (d) occurrence of adequate response and (e) reinforcement of drinking response. Further, in cases of relatively helpless neonates, the total mechanism must include environmental elements, e.g., mother to provide liquid until the infant is able to acquire adequate learned patterns independent of mother. It is the combination of need and cue that leads to general activity or variability in behaviour.

## 19. The socio-psychological study of inter-group tensions.

J. C. PRAKASH.

In a recent article Bernard M. Kramer presents the thesis that a study of group-prejudice should be based on an investigation into the differentiated aspects of prejudice rather than on the facile assumption of the unitary character of prejudice. Kramer presents a specific frame work of differentiated dimensions of prejudice and suggests this approach for further research.

The present study is a pilot investigation of an exploratory character and aims at applying this dimensional approach to a study of inter-group attitudes—the groups thus studied being—Muslims, Hindus, Brahmins, Harijans, Lingayets, and Vokkaligas.

This application has yielded fruitful results. These are summarised under three headings.:

(i) The influence of ingroup-cutgroup affiliations on intergroup attitudes., where it is shown that the generality of prejudice is a function of ingroup-outgroup it is shown that the generality of prejudice is a function of ingroup-outgroup cleavages.

(ii) The acceptance of the hierarchical caste structure and its bearing on the inter-group attitudes at various levels of the hierarchy where the specific inter-caste attitudes are shown to be the resultants' of the acceptance of caste system and the upper or the lower status of the groups in question.

(iii) The group-belongingness and group privilege, where the degree of identification of each social group is shown to be a function of the satisfaction it derives from its membership in a given social group.

## 20. Levels of experience in normal personality.

INDRA SEN, Pondicherry.

General psychology, on the whole, recognises two levels of growth in normal personality. They are, Perception and Ideation and James Ward was perhaps the first to demarcate them clearly. The "Representational Continuum" (the Perceptual level) is marked by a persistence and intensity dependent upon the objective determination of the process. The "Representational Continuum" (the ideational level), grows out of the presentational continuum and is, on the whole, not marked by such persistence and intensity and is primarily determined by the subject's interest and activity.

Stout carried out the idea of these two levels with greater thoroughness, so as to divide his psychological treatmeent of personality into two distinct parts: one, deal ing with perception, instinct, emotion, imitation etc., the other, with thinking, imagination, memory, voluntary action etc.

McDongall too builds upon the same plan. However other leaders of contemporary psychology do not strictly adhere to it, though they naturally admit of growth. Some of them evolve their own schemes of different stages of development, which, however, seem to recognise the difference of the perceptual and ideational.

This recognition is based on facts of evolution, the progress from the animal to the human and is, therefore, an important, valid and useful approach to the understanding of the human mind and its relationship with the animal mind'

But Sri Aurobindo finds this treatment of levels of experience unsatisfactory. He affirms that the use of the term 'mind' and 'mental' is too loose in modern psychology. Says he, "We are composed of many parts each of which contributes something to the total movement of conscieousness, our thought, will, sensation, feeling, action, but we do not see the origination or the course of these impulsions."* Now the main parts, which represent our fundamental evolutional levels are: Matter, Life and Mind,—the *anna*, the *prana* and the *manas* of the Upanishads. These levels are equally recognised by modern science. Now if man is an evoluntionary product and synthesis of all these three, then this consciousness and behaviour would involve and represent an influence of them all and disengagement and identification of their several and joint working would naturally be the most useful approach to the understanding of personality. Sri Aurobindo gives a detailed characterisation of Matter, Life and Mind as distinct facts and also shows how they are variously combined in the different concrete activities of the psycho-physical personality and how the identification of their relative working is an aid in the understanding and the control of those activities.

This conclusion regarding the nature of human personality based on the facts of general evolution can be verified and supported by individual introspection, which, however, must have been developed to a high degree of dispassionate and impersonal observation of inner facts. Says Sri Aurobindo, "as soon as one gets behind the ordinary surface consciousness one sees them (the three parts) as separate, discovers their distinction and can with the aid of this knowledge anaylyse their surface mixtures."†

This plan of three levels obviously takes account of evolution in its full range and is in possession of the key terms of the material of human personality and can, therefore, be a sounder approach to its understanding.

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* Lights on Yoga (1948) p. 15.

† Lights on Yoga (1948) p. 22.

# 40th INDIAN SCIENCE CONGRESS LUCKNOW, 1953

## SECTION OF AGRICULTURE

PRESIDENT : DR. N. PARTHASARATHY, B.A., B.Sc. Ph.D.,F.N.I.,

## *Abstracts*

### 1. Trials with maize hybrids and varieties in India.

G. S. MURTY, New Delhi.

The best method of increasing the present low acre yield of maize in India lies in the proper exploitation of hybrid maize. While attempts at isolation suitable inbreds and making double crosses from them are under way, the quickest way to attain increased yields seems to be to use some of the double crosses already evolved in other countries.

Some U.S. Hybrids obtained through the courtesy of the United States Department of Agriculture and the Food and Agiriculture Organisation were tried at four centres against Pusa Yellow (2) as the check, in 1949-50. Though late sowing and unfavourable seasonal conditions prevented a proper estimate of the potentialities of these hybrids, there were indications of their superiority over the control. In 1950-51, 36 U.S. hybrids were tried against the best local varieties at 17 locations, representing the main maize growing tracts in India. The trials were repeated in 1951-52 with certain selected ones out of these 36 and 12 hybrids newly received from U.S.A. in March, 1951. These trials were held at 14 locations.

From the results it is seen that a number of hybrids, especially those which are medium-late or late in maturity, give significantly higher yields than the respective controls, while very early maturing types were, as a rule, poor yielders. In general hybrids from Texas, Indiana, Iowa and Ohio gave superior performance. Hybrids from Wisconsin and Minnesota proved to be too early for Indian conditions and also very poor in yield.

The various inbreds that go into the double crosses are proposed to be imported and increased with a view to ultimately making the double crosses in India itself.

Inbred lines isolated from various sources have been tested during the last season (1951-52) for their combining ability in top classes and some single cross combinations. This work will, in due, course of time, lead to the development of Indian double cross hybrids which may be more productive under our conditions than the imported ones.

### 2. Cytology of some Malayan mangifera.

SUNIL KUMAR MUKHERJEE, Delhi.

Observations on somatic chromosome number and morphology of *Mangifera, foetida* and *M. caesia*, two species of *Mangifera*, widely cultivated in Malaya for their fruits, and meiotic behaviour of the former species have been made from fixed flower buds and seeds of the species, from Singapore.

Chromosome numbers of both *M.foetida* and *M.caesia* are $2n=40$, the same as in *M. sylvatica*, *M. india* & *M. caloneura* reported earlier by the author, showing that *Mangifera* has stability in chromosome number of its species. *M. caesia* has chromosome varying from 0.6 to 2.0, in size, and a total chromosome length of 39 $\mu$ per nucleus. *M.foetida* has 0.6 to 1.6 $\mu$ long chromosomes. Specific variations within the genus appear to be due to gene mutations, minute structural variations, and to recombinations by interspecific hybridisation. Cytological analysis of the hybrids will help in further elucidation of the process.

Meiotic behaviour is regular in *M.caesia*, as observed in other species. During diakinesis and metaphase 20 bivalents are clearly seen.

The chromosome number and morphology, as also the pollen morphology of these species are similar to those of *M.indica*. This suggests that close compatibility may be expected during interspecific hybridization between these and the common mango.

## 3. A study of Tetraploidy in Rice.

S. Sampath, Coimbatore.

Using aqueous colchicine solutions, tetraploids of homozygous and hybrid rice types have been produced. A total of three autopolyploids and ten allopolyploids are being grown. Soaking rice seedlings in 0.2 per cent colchicine solution for 12 hours is effective in inducing tetraploidy. The tetraploids are all semisterile and are not suited for cultivation. Attempts are being made to reduce sterility by increasing variability and subsequently selecting for fertile types. Some tetraploids show a good ratooning capacity.

## 4. Growth of wheat plants in culture solutions.

R. M. Singh, Agra.

A water-culture experiment was conducted to study the response of wheat (Pb. 591) plants to varying amounts of iron and to determine the critical period of life cycle when the plant needs iron. Three leaves of iron—$Fe_0$ (no iron), $Fe_{\frac{1}{2}}$ (6.45 *p.p.m.*) and $Fe_1$ (12.91 *p.p.m.* of solution culture) were supplied at different stages of life cycle. Under the last two levels iron was supplied upto first 20, 40, 60, 80 and 100 days of life cycle and then withheld, while in the case of no iron level iron was with-held in the first 20, 40, 60, 80 and 100 days and then supplied. The growth was measured in terms of dry matter production per plant (shoot). The results are discussed and following are the conclusions:–

1. Application of iron irrespective of levels significantly increased the dry matter production.
2. Wheat plants respond to iron upto 30 days only and the critical period lies between 60 and 80 days; iron more than 6.45 *p.p.m.* has no significant effect on dry matter production.
3. Deprivation of iron after 40 days significantly reduced the dry matter reduction.

## 5. Manganese nutrition of plants; I. Role of iron/manganese ratio and calcium.

S. C. Mandal, Sabour.

Peas and soybeans were grown in a modified knop solution with varying concentrations of calcium, iron and manganese.

Pea plants growing in solutions containing 0.05 p.p.m. of Mn accumulated 420 p.p.m. of Mn in its tissues, whereas the same plants growing in ten times higher manganese concentration accumulated only 85 p.p.m. of Mn. It was found that the accumulation of Mn in plants depends not so much on the absolute quantity of Mn alone in the solution, nor on the iron/manganese ratio of the solution, as on the absolute quantities of all the three ions viz., Fe, Mn and Ca and their interactions. Again, Pea plants accumulating 570 p.p.m. of Mn were not found to develop toxicity but the same plants with 390 p.p.m. in their tissues developed highly toxic conditions. This anomaly can be explained on the basis of nutrition of other ions. Evidences have been found to suggest that there must be some calcium/manganese, iron/manganes or similar ratios in the plants below which toxicities are likely to develop.

Since peas and soybeans differed widely in their growth behaviour in similar concentrations of Fe, Mn and Ca, the individual plant character should be regarded as an additional factor in the manganese nutrition of plants.

## 6. Improvement of soil fertility by the application of heat.

H. N. Mukerjee, Sabour

It has been known from ancient times that heating of soil has a beneficial effect on crop growth. The author has studied the effect of heat on the changes in the plant nutrient status of the soil solution, of soils treated with or without organic matter, under cropped and uncropped conditions, throughout the growth period of the crop. It has been found that the concentration of the soil solution increases steadily with the temperature and time of heating, till on heating at 200°C. for one hour, 4699 parts per million of total solids appear in the soil solution, as compared to only 189 parts in the unheated soil. Phosphates and organic and ammoniacal nitrogen are similarly increased in the soil solution, and this is maintained throughout the growth period of the crop. Bacterial population and nitrates get depressed for about 6 weeks, but increase later. Potash is depressed throughout, but even then its intake by crops is much higher. Hence although physical and microbiological changes are involved, the beneficial effect of heat is mainly due to the appearance of more plant nutrients in the soil solution. Practical application of soil heating on the problem of growing crops on an extremely poor waste land has given very encouraging results. This soil has a high content of organic nitrogen (0.20%), but grows only a very poor crop. Burning enough of the grass growing wild on these soils for about one hour increased the yeilds of crop considerably, and it appears that the resistant orgenic matter in the soil, is broken down by the heating process, and then an increased supply of available nutrients appear in the soil solution.

## 7. Maintenance of soil fertility by rotation of crops.

S. C. Mandal, Sabour.

Work at Sabour has revealed that legumes in our rotations need scrutiny since most of the common legumes have not been found to enrich the soil. Some work should be done, in this connection, on the incorporation of our neglected forage legumes in our rotations. Kalai grown for grain was found, at Sabour, to increase the yield of the succeding crop of wheat by about 110% in comparison to maize. In another experiment soybean was found to depress the yield of wheat by about 75% when compared to the yield of wheat after maize. Fallowing increased the yield of wheat by about 60 to 100% over that grown after green manuring or maize. This has been due perhaps to an increased state of aggregation by fallowing (10 to 15%) increase in water stable aggregates greater than 0.25 mm over green manuring. The necessity for introducing grass legume leys in our rotations, for renovating our run out soils, has also been examined. As a preliminary step some grasses and clovers imported from abroad have been tried for their adaptability to soil and climatic conditions of Sabour. Clovers e.g. Burr medic were found to add nitrogen up to 400 lbs. per acre in one season. Work is progressing on the working out of some pasture mixtures for Bihar.

## 8. Applicability of methods for the determination of available phosphates for jute.

M. K. MUKHERJEE *and* G. HALDER, Barrackpore.

For introducing a soil testing service to farmers, the analyst must have suitable methods.

In order to find a suitable method for jute, the present investigation was undertaken and the following methods, viz.

(i) Truog's, (ii) Egner's, (iii) Williams's, (iv) Michigan, (v) Wisonsin, (vi) Pennsylvania, (vii) Kentucky

were compared against the inorganic phosphate concentration in tip leaves using O40–632 type of C. Olitorius as indicator plant in case of 16 plots including cultivators' plots and it has been found that the method followed in Kentucky (Extraction with 0.15*N* sulphuric acid) gives the best indication as to the available phosphate status of different soils if they are situated in closely lying areas having same pedological conditions.

## 9. A preliminary investigation of the phosphate status of jute soils.

M. K. MUKHERJEE, Barrackpore.

Soils of the upper Damodar valley and Indian red and laterite soils are very poor in their available phosphate content, but these soils contain considerable amount of alkali soluble inorganic, organic and reserve phosphatic compounds.

The available phosphate content of the jute soils are fairly high in comparison with the above mentioned soils. Extractions by Truog method gives the highest figures, by Williams's method an intermediate figure and by Egner's method a very low figure. Organic phosphatic compounds are fairly high but alkali soluble inorganic and other phosphatic compounds are not very high in these soils.

It may be mentioned here that the ratio between available phosphates as determined by Truog and acetic acid methods lowers down on storing for a long time (from almost 1 : 1 to 1 : 10 or so).

## 10. Indicator plant studies using tomato (*Lycopersicon Esculentum*).

W. V. B. SUNDARA RAO *and* S. P. SETH

In continuation of the earlier studies with indicator plants, studies were conducted with tomato plants (Recruit variety) in pot culture experiments. The soil selected contained 0.028% and 0.0114% citric acid soluble $P_2O_5$ and $K_2O$ respectively. The treatments were (1) unmanured, (2) N, (3) P, (4) K, (5) NP, (6) NK,

(7) PK and (8) NPK, with 6 replications per treatment. Each pot had two tomato seedlings.

Characteristic nitrogen deficiency symptoms appeared 7 weeks after transplanting. There were no $P_2O_5$ and $K_2O$ deficiency symptoms. This showed that while nitrogen supply level was very low, those of $P_2O_5$ and $K_2O_5$, were not so low as to induce deficiency symptoms in the plant.

The yield data showed that even in the soil where citric acid soluble $P_2O_5$ was fairly high response was obtained when phosphatic fertilizers were added along with N. This result appears to be due to two factors. Firstly the $P_2O_5$ fertilizer was intimately mixed in the entire soil so that $P_2O_5$ was not fixed only at the surface, but was also available near the root zone as well. Secondly, at the high doses of N, the response to the large additions of $P_2O_5$ ,could easily be expected. These results stress the need to conduct placement of phosphatic fertilizer experiments with Delhi soil before definite conclusions could be drawn regarding response in these soils to additions of phosphatic fertilizers. The depression in the yield due to NPK as compared to NP, and the general lack of positive response to the $K$ addition indicated that the soil reserves of available $K_2O$ were sufficient to meet the plant requirements.

The fruits were analysed for moisture, ash, N, $P_2O_5$, $K_2O$ and CaO and in general, NP treatment appears to be the best in giving higher yield of fruit with higher percentage composition of nitrogen and phosphorus when compared with the control and different treatments.

## 11. Properties of Ganges Silt.

R. N. SEN, Palta *and* B. CHATTERJEE, Sibpur.

Mechanical analysis, base exchange studies and chemical analysis of the Ganges silt collected at Palta Water Works (Barrackpore) during 1950 and 1951 have been carried out. It has been observed that the silt collected during the premonsoon months contains montmorillonite as the dominant clay mineral while that which settles during the monsoon season contains considerable amounts of illite. The nature of the exchangeable bases of silts has also been found to change with season. The variation in the nature of the clay material deposited in different seasons is being studied from the points of view of the utilization of the Ganges silt as also of alum economy for purifying water.

## 12. Variations in the Nitrifiability of soil nitrogen.

C. N. ACHARYA, New Delhi.

A comparison of a number of soils differing in their physical and chemical properties showed considerable variation in the percentages of their total nitrogen which could be nitrified in the laboratory under optimum conditions. In one Group (A) of the soils, only 5 to 6% of the total nitrogen was nitrified in about 5 months' time, whereas in another Group (B), about 10 to 12% of the total nitrogen was nitrified in the same period. Estimations of the numbers of nitrifying organisms by the dilution method showed that Group (A) possessed smaller numbers varying from 500 to 2000 per gram of soil, whereas Group (B) possessed higher numbers ranging from 5000 to 10,000 per gram of soil.

The low nitrifying powers and low numbers of nitrifying organisms in Group (A) appear to be correlated with the wider C/N ratios of the above soils (12 to 13), compared to the soils falling under Group (B), which possess narrower C/N ratios (8 to 10).

There is no correlation with the mechanical analysis, base exchange capacities or calcium or $P_2O_5$ contents of the soils. pH of all the soils examined was between 7 and 8.

## 13. Investigation in physical & chemical and Biological properties of Black Soils of Malwa under Tractor Cultivation.

R. V. Tamhane *and* P. M. Tamboli, New Delhi.

Work has been conducted on Black Cotton Soils of Bhopal State to study the likely changes in its physical, chemical and biological properties, due to the introduction of Tractor Cultivation.

A comparative study of the virgin and tractor ploughed soils reveals that the mechanical composition is unaffected, whereas the structural condition is affected as is evidenced by the permeability, porespace, volume-weight and the distribution of water stable aggregates. The virgin soil has shown less susceptibility to erosion as indicated by dispersion and erosion ratios.

The nutrient status as judged by HCl. soluble constituents and Base exchange capacity and exchangeable bases remains unaffected. However, there is a lowering of the organic matter content and total nitrogen.

The Biological activity is found to be more in virgin soils than in Tractor ploughed soils, as indicated by total count nitrogen fixing power and nitrifying power.

In general, it may be said that while the chemical and biological properties remain unaffected, the physical properties, especially the structure and other related properties are affected due to Tractor Cultivation.

## 14. Characteristics of the soils of Dabar Tract-Delhi State.

K. V. S. Satyanarayana *and* Y. P. Bali, New Delhi.

The *Dabar* area is a low lying tract situated in the South West side of Delhi ridge and remains flooded during the rainy season. It comprises a total area of about 91,693 acres. The area is covered by the Indo-Gangetic alluvium and fine sands of aeolian origin of considerable depth, and the rolling topography of the area is marked by sand dunes and sand ridges. The natural vegetation is mostly made up of short grasses and xerophytic types characteristic of the general semi-arid climate of the area. The soils are of coarse texture ranging from sands to sandy loams containing a low amount of organic matter and frequently no calcium carbonate in the profile. There is slight eluviation of clay into the lower horizons, otherwise, the profile development is very elementary. But in certain low lying area of this tract the subsurface horizons of the profile show a compaction, cloddy to prismatic structure and an alkaline reaction. These soils are unproductive. The normal soils show sufficient reserves of important plant nutrients except nitrogen, but their availability, in general, is low. The soils fall under the zonal category of grey and brown soils of semi-arid and desert.

## 15. Number of saline soils of Delhi State, Part IV.

S. P. Raychaudhuri *and* N. S. Sinha, New Delhi.

The paper deals with the pedological classification of the saline and alkaline soils of Delhi. On the basis of examination of 10 soil profiles at different areas of the State the soils can be classified into following three pedogenic groups:-

(1) *Saline soils*—mostly in new alluvium of *khadar* area; soluble salts high, pH is less than 8.5; structureless, $CaCO$ in small amounts,

(2) *Saline-alkaline soils*—in *Dabar*, *Bangar* and in old deposits of *khadar* area, moderate soluble salts, pH– 8.2 to 8.8, cloddy in structure, increase in CaCO at lower depths,

(3) *Saline-alkaline soils with kankar formation*—mostly in *Dabar* and *Bangar* areas and in the depressions of *khadar* area; heavy texture, limenodules at 3 to 5 ft. depth below the surface, highest soluble salt in *kankar* zone; pH above 8.5, high exch. Na.

The soils may be classified as belonging to 'Great Soil Group' of saline (Solonchak) and saline-alkali soils.

## 16. Studies on some irrigation water in the Delhi State.

S. P. Raychaudhuri *and* N. S. Sinha, New Delhi.

A few samples of well water were studied as to their suitability for irrigation. Salt indices as determined by Puri's method was found to be a reliable method for determining the suitability of water for irrigation purposes. Salinity was not a reliable index for determining the suitability of water for irrigation purposes. Salt indices were high in cases of water having high sodium content.

## 17. On the nature of the saline soils of the Delhi State, Part III.

S. P. Raychaudhuri *and* N. M. Nimgade, New Delhi.

In the present study, saline horizon samples of two profiles at villages Gheora and Kamruddin Nagar were examined.

The soil profiles at Gheora and Kamruddin Nagar showod neither horizon differentiation nor structural formation, the differentiating features being the reaction to HCl, root penetration, and change in colour of layers. The water table is fairly high in profile I (Gheora at 58").

In general, soils are sandy to sandy loam. The concentration of water soluble salts decreased with depth in profile I (Gheora) from 1.33% to .606% upto 22" and again increased from (22") .606 to .731 (58"). In profile II (Kamruddin Nagar) the total salt first decreased from .25% to .140% at 30", and then increases from .140 to .416% with depth. The origin of the salts in the profile I could be traced to the movement of underground water which is high in salt concentration. Profile II area (Kamruddin Nagar) might be rendered saline by the application of adjacent well water for irrigation which contains very high amount of total soluble salts (790 p.p. 100,000) with a pH of 8.2.

The pH of water extract (1 : 2.5) increases with depth in the case of both profiles indicating increasing alkalinity at lower layers. Water of adjacent wells at both places contains high amount of total soluble salts 790 and 209 parts per 100,000 at Gheora and Kamruddin Nagar respectively and are therefore unfit for irrigation. However the canal water of Gheora village which contains total soluble salts 60 p.p. 100,000 is fairly good for irrigation.

The soils are well supplied with $K_2O$. Abnormally high values of HCl soluble and available $P_2O_5$ were obtained. Exchangeable Ca is approximately double the amount of exchangeable Na in the top horizons (0–6") in both the profiles. In the subsoil layer (6"–18") in Kamruddin Nagar the exchangeable calcium is relatively much higher.

The morphological features coupled with the chemical and physico-chemical properties suggest that these soils come under the "Solanchak" world group.

## 18. Clay minerals and their importance in the classification of soils.

S. P. Raychaudhuri *and* B. B. Roy, New Delhi.

The physical and chemical properties of soils ultimately depend upon the nature and amounts of clay minerals contained in them and it is thus essential that the classification of soils should primarily be based on the mineralogical make up of the clays. In the present paper the characterisation of the minerals present in clays isolated from several typical soils profiles of different localities of India have been discussed and correlation of the nature of the clay minerals with these soils types made. Martmorillonite has been found to be the predominant mineral constituent in the clays from *regur* or black cotton soils of India. There was no variation in the mineralogical composition down the profile. In laterite, lateritic and red soils the chief mineral constituent is kaolinite. Soil from Delhi occurring within the Jumna alluvium region has illite as a major constituent of the clay, its propertion decreasing gradually with depth. The other constituent is montmorillonite, the proportion of which increases correspondingly. Soil from Karnal (Punjab) also occuring within the Indo-Gangetic alluvium belt, has, however, kaolinite as the main constituent of the clay fraction, but the top horizon upto 26 inches also contains some montmorillonit materials. In both these cases the montmorillonite-illite clay minerals in the profiles have probably originated from the wind borne dusts from the adjacent Rajputana desert. It also appears likely that the non-occurance of magnesium in the Sambar Lake water is due to the disappearance of magnesium from wind borne sea salt for conversion of illite into montmorillonite occurring in the clay complex.

## 19. Investigations on time-saving methods of analysis. I. Mechanical Analysis of soils.

U. P. Mishra *and* H. N. Mukerjee, Sabour.

It is often necessary to examine large numbers of soil samples in connection with extensive soil survey and other work of an advisory nature, and hence investigations were taken up to test quicker and cheeper methods, and a start was made with the mechanical analysis of soils.

The International methods was taken as the standard, and a saving of time and money in this was attempted by omitting the hydrogen peroxide treatment. Puri's method of dispersion by sodium carbonate—sodium hydroxide with pipette sampling, and Bouyoucos's method of dispersion with sodium silicate—sodium oxalate and sampling with hydrometer were also tried as time saying methods.

It was found that in the sixteen Bihar soils studied, from different soil types and different depths, the need for hydrogen peroxide pre-treatment appeared to be essential, because without this, the clay contents were less by 3–10%. Puri's method of dispersion was not found to be satisfactory, as differences of 3–5% were observed in the clay contents. Bouyoueos's method was very satisfactory and gave results agreeing to within one percent in thirteen of the sixteen soils studied. In the other three cases the difference was within 2–3%. Further, this method requires only one-seventh of the time and money, that are required for mechanical analysis by the International method. A cheap hydrometer for the work has been made and calibrated in this laboratory, which is working very satisfactorily.

## 20. Conversion of Montmorillonite into illite.

B. CHATTERJEE, Sibpur.

The lattice structure of montmorillonite and illite are very similar and as such transformation of the one mineral into the other may not be impossible during diagenesis process. Some data have been obtained in the present investigation which indicate that a transformation from montmorillonite to illite may be brought about even under laboratory conditions. The clay fraction, i.e., particles having equivalent spherical diameter of less than 0.002 mm., isolated from a sample of bentonite from Kashmir has been treated with potassium chloride under slightly alkaline condition thus simulating in laboratory natural conditions under which illite is formed. To hasten the process, the mixture of clay plus salt solution was evaporated to dryness on water bath, sufficient water was added to dissolve the pottassium chloride and reevaporated. This sequence of operation has been repeated everyday for two months. The clay was then washed of potassium chloride with 0.03N hydrochloric acid and finally the excess acid was removed with distilled water. The $K_2O$ content of the clay has been found to increase from 0.70 per cent to 1.45 per cent indicating that the illite content of the clay has increased from about 10 per cent to about 25 per cent by KCI-KOH treatment. This observation is corroborated by X-ray analysis in that in the powder diffraction pattern of the untreated clay the illite line (10 A°) could scarcely be detected while the intensity of this line in the x-ray diagram of the treated clay indicated that the latter contains about 20 per cent illite. The results obtained in the present investigation seem to offer a plausible explanation of potash fixation observed in montmorillonitic soils heavily fertilized with this fertilizer. Potassium enters into the lattice structure of the mineral under these conditions and therefore is no longer replaceable, i.e., it is fixed.

## 21. Studies on the nicotinic acid content of wheat.

B. G. PRASAD, Y. P. GUPTA, T. D. BISWAS *and* N. B. DAS, New Delhi.

As a part of a detailed programme of investigation on the nutritive value of different varieties of Indian wheat, fourteen important varieties were analysed for their nicotinic acid content Different chemical methods described by Wang and Kodicek, Friedemann and Frazier, and Chaudhuri were compared with the microbiological method. The results obtained by all the methods agreed well.

The variation of the nicotinic acid content from variety to variety as estimated by Chaudhiri's method is wide and is as follows : NP 52–48.3; NP 4–46.2; NP 111–45.4; NP 12–44.5; C 13–43.7; NP 165–41.2; NP 760–40.4; NP 710–40.1; Pb.C. 591–39.4; Pb. C 518–37.6; NP 721–35.7; NP 775–33.5; NP 715–33.3; NP 718–29.9 $\mu$g/g. The variation in the content of free and bound form of nicotinic acid is 2.6 to 7.4 and 24.1 to 40.9 $\mu$g/g respectively. The varietal difference in this constituent is highly *significant.* There is no correlation between the protein and nicotinic acid content.

## 22. Studies on the Riboflavin Content of Indian Wheat.

Y. P. GUPTA *and* N. B. DAS, New Delhi.

The present report relates to the study of Riboflavin (Vitamin $B_2$) content in different varieties of wheat.

Twenty-eight different varieties of Indian wheat are analysed for their riboflavin content by the microbiological method as described by Snell and Strong (1939) with a slight modification, replacing Difco-yeast extract by Oxo-yeast extract which has been found to give satisfactory results.

The value of Riboflavin content varies from variety to variety from 0.99 *μg/g* to 1.18 *μg/g* of whole wheat on dry basis. The content of Riboflavin in different varieties is given below:–

NP 4–1.05; NP 12–1.08; NP 52–1.08; NP 704–1.07; NP 710–0.99; NP 715–1.00; NP 717–1.03; NP 718–0.93; NP 720–0.94; NP 720–1.05; NP 723–1.18; NP 733–1.06; NP 737–1.01; NP 745–0.97; NP 755–0.91; NP 758–1.02; NP 760–1.12; NP 761–0.99; NP 762–0.94; NP 764–1.02; NP 768–1.02; NP 770–0.90; NP 771–1.15; NP 775–1.08; NP 779–1.12; C 13–1.01; Pbc 518–0.94; Pbc 591–1.02.

It has also been found that there exists no correlation between the Riboflavin content and the Nitrogen content of the whole wheat grain

## 23. Chemical Composition of Wheat as influenced by Manures and Fertilizers.

N. B. DAS *and* Y. P. GUPTA, New Delhi.

It has been claimed by certain workers that the composition of Cereals is influenced by manurial and fertilizer treatments while others observed variable results. In view of this conflicting findings investigation is taken up with the object to find out the effect of manures and fertilizers on the constituents of wheat.

Wheat collected from each plot having different treatments is analysed for its moisture, N, Ash, Sand, Ca, P, fat, crude fibre contents.

Protein content of the grain appears to vary with different treatments. Rape, cake, N, K, NK, and green manure have increased the Protein content of the grain but N and K in combination with P and NPK have decreased the Protein content of the grain.

Rape cake, FYM, P, PK, NPK have increased the ash content of the grain.

FYM, P, PK, NPK, NP, Green Manure alone as well as in combination with Phosphate treatments have increased the P content of the grain. Only N treatment has slightly decreased the P content.

FYM, Rape cake, NPK, NP are found to have increased the Ca content of the grain but green manure alone as well as in combination with Phosphate have decreased the Ca content of the grain.

## 24. Studies on the presoaking of ragi seeds with nutrient salts. Influence of zinc salts on crop yields.

S. V. GOVINDARAJAN, Bangalore.

Application of Zinc salts to soils are found to give increased yields of Ragi (Eleucine Coracana) crop in Mysore State. Seed treatment with solutions of Zinc sulphate are found to give similar increased crop yields under both dry and irrigated conditions of cropping. Dosages as low as 1% of Zinc salt on the weight of seed used, are found to be effective. Results of plot and field trials are discussed.

## 25. Influence of manuring on the yield and composition of paddy and ragi. A study on the recovery of plant nutrients in the crops.

B. V. VENKATA RAO *and* S. V. GOVINDARAJAN, Bangalore.

Cereal crops in general are found to respond readily to nitrogenous fertilizers, while the response to phosphates have not been so general and at times negative. In this paper the results of six experiments with varying doses and combinations of nitrogen and phosphorus on paddy and ragi (Eleucine Coracana) are reported. The analysis of the crop for Ash, Phosphorus and Nitrogen in the several treatments in the different experiments have also been carried out. The percentage increases in grain and straw, weight per earhead and the ratio of straw to grain generally indicate that phosphorus has a favourable influence on grain formation. The recovery of the added nutrients are considerably influenced by the proper combination of fertilizers. Phosphorus given in combination with nitrogen aids much better uptake of nitrogen than when the extra phosphorus is dropped out. The nitrogen appears to have a similar complementary influence on the phosphorus uptake. Thus the mutual interrelationship of the two elements is brought out and the need for adequate balance between these two nutrients for optimum crop yield and maximum recovery of the nutrients is thus stressed. The recovery of the added nutrients in Ragi is much less complete than in the case of paddy, and the indications are that the moisture relationships of the soil and crop have a considerable influence on the uptake of the added nutrients.

### 26. Studies on the efficient utilization of phosphatic fertilizers for ragi. Effect of composting superphosphate with farm manure.

B. V. VENKATA RAO *and* S. V. GOVINDARAJAN, Bangalore.

In this paper results of two experiments on Ragi (Eleucine Coracana) to study the effect of mixing phosphate and Farm Yard Manure together before application as against the usual practice of applying them separately are reported. In addition to recording the effect of these treatments on crop yields, the crops have been analysed for ash, $P_2O_5$ and N and the recovery of the same have been calculated. It is found that applications of phosphate mixed before hand or composted with Farm Yard Manure, result in appreciable increase in yields of Ragi grain and straw and that the total amount of $P_2O_5$ removed by the crop is increased considerably indicating better and more efficient utilization of the added phosphate.

### 27. Retting of *Girardinia heterophylla*, a nettle occurring in the hills of subtropical regions.

B. C. KUNDU, M. K. MUKHERJEE, A. K. KUNDU *and* G. HALDER, Barrackpore.

Experiments were undertaken to study the normal retting process as well as the effect of different chemicals like, sodium hydroxide, sodium carbonate and potassium carbonate, on the retting of *Girardinia heterophylla*, one of the most important fibre producing nettles. The fibre content of this nettle is nearly 2% of the stem.

It was found that sodium hydroxide was the best. Data regarding, ammoniacal-nitrogen, nitrate nitrogen, phenolpthalein-acidity, and methylorange alkalinity and water soluble phosphates are given for the normal retting process.

### 28. Placement studies of phosphatic fertilizers on wheat crop.

GAJADHAR SINGH, Agra.

A series of experiments were conducted during the years 1949-52 with varying doses of phosphate applied at varying depths with and without nitrogen on wheat crop in a two year rotation-fallow, wheat, juar, wheat. The results are summarized below :—

(1) Nitrogen seems to be a limiting factor in Bichpuri soils. In all the experiments nitrogen significantly increased the yield of wheat.

(2) Superphosphate proved a better fertilizer than bonemeal.

(3) Low doses of phosphate (20 and 40 lbs. $P_2O_5$ per acre) were not effective in increasing the yield. The highest dose of 240 lbs. $P_2O_5$ per acre significantly increased the yield over control. But the response per lb. of $P_2O_5$ was higher for lower dose of phosphate (120 lbs. per acre). In Phosphate deficient soil, phosphorus produced a marked effect where increasing doses (0.60, .120 lbs. $P_2O_5$) significantly increased the yield.

(4) There is a definite indication that placing the fertilizor at 6″ depth was better than surface, 3″ and 9″ placement. In new area 4½″ placement was decidedly better than surface 1½″ and 3″ application.

(5) In other experiments residual effect in juar fodder (green) was found to be highest with 240 lbs. $P_2O_5$ and it was significantly more than those under control and 120 lbs. $P_2O_5$ per acre.

## 29. Studies on Crop-weed competition in wheat field.

### H. K. Pande, Agra.

In weeding experiments with wheat conducted at B.R. College, Agricultural Research Farm, Bichpuri (Agra) during three successive 'Rabi' seasons of 1949-50, 1950-51 and 1951-52. it was found that the number of ear bearing tillers per plant, the yield of grain per plant and the grain yield per acre were significantly higher under weeded plots as compared with the non-weeded. Under normal fertility of the land the weeding treatment increased the yield of grain per acre by 26.1%, yield of grain per plant by 46.6% and number of ear bearing tillers by 29.6% over no-weeding. When the experiment was conducted under high and low fertility levels, the percentage of increase under low fertility level was more marked; viz., 31.5% for grain yield per acre, 65.1% for yield of grain per plant and 76.8% for ear bearing tillers per plant. It is evident that the competition was more severe when there was scarcity of plant nutrients. The comparison of the effect of the removal of the weeds by hand-pulling and that by 'khurpi' was clearly indicative of the fact that only removal of the weeds from the competition with the crop had the beneficial effect and not the creation of mulch brought about with the use of 'khurpi'.

## 30. Cheaper sources of phosphates and their utilisation by plants.

### H. N. Mukherjee *and* S. C. Mandal, Sabour.

To meet the demand for a general need of phosphates for Bihar soils, investigations were taken up, with the object of finding out, if the rockphosphate deposits of the Singhbhum district could be profitably used for increasing crop yields, to the same level as obtained by superphosphate. It has been found in a number of field experiments that rockphosphate when used with ammonium sulphate or Castor Cake gives yields which are almost as good as those obtained, when the source of phosphate is superphosphate. When used with compost or in soil acidified with sulphuric acid, or when added during the turning down of sanai (green-manure), the effect of rockphosphate is better than that of superphosphate. Lowering of soil pH by acidifying, from pH 7.7 to 6.9, reduced the amounts of phosphates fixed in the soil, from 62%

to 25%, and it appears that the organic acids produced by the compost or green manure, protects the phosphates from being fixed in the soil, either by forming organo-mineral phosphates or by local lowering of pH. These results were obtained on Sabour soil, and if other soil types respond similarly, a very cheap source of phosphate would have been found. Further investigations are proceeding.

## 31. A new use of Ferguson potato-planter as sugarcane-sett-planter.

(MISS) R. SHAH *and* T. C. N. SINGH, Bangalore.

Experiments have been done to adapt the Ferguson Potato-planter for planting sugarcane setts and it has proved successful.

Under this new oriented device the two most important and costly operations of sugarcane plantation, namely those of trenching and planting are simultaneously effected with ease and efficiency in one operation only, thereby bringing about a good deal of economy in the cost of cultivation.

## 32. Studies on weed eradication in Uttar Pradesh.

T. N. SHIVAPURI *and* R. P. SINHA.

Preliminary trials were conducted to eradicate *Asphodelus tenuifolius* and *Chenopodium album* by selective herbicides (weedicides) in the Rabi season of 1951-52.

Fernoxone (sodium salt of 2.4-D), Agroxone (5% methoxone dust) and Dicotox (2.4-D) were tried at different concentrations in plots of 1/40th acre, replicated three times, in a wheat field. Besides, the treatments included mechanical weeding and a control.

These weedicide sprays killed all the weeds competely in three weeks. *Melilotus indica, Melilotus alba, Medicago denticulatus* and *Convolvulus arvensis* were also killed, but *Spergula arvensis* remained unaffected.

There was no deleterious effect on the crop, except in the plots treated with 4 gallons of Dicotox per acre, under which about 7% of the ears of wheat were peculiarly 'cockled'.

As far as the yield is concerned, mechanical weeding can be put at par with the use of selective herbicides, but of all the treatments, Agroxone @ 2 lbs. per acre gives the highest profit over control. Spraying costs only Rs. 2-3-6 per acre with Agroxone, while that of mechanical weeding costs Rs. 18-12-0 per acre.

## 33. Biological eradication of *Saccharum spontaneum* Linn. (*kans*).

T. C. N. SINGH, Annamalainagar.

Observations during the last three years in the Botanic Garden of the Annamalai University, have shown that healthy clumps of *kans* in an interaction with *Rottboellia myurus* Benth. (basket grass) have all been killed outright and dried down *in situ* and that the basket grass, thereafter has subsequently succeeded in the area as a pure formation.

Experiments were carried out under controlled pot culture; and it has been found that vigorous healthy clumps of *kans* irrigated fortnightly with root washings of the basket-grass, were killed in the experimental pots within a period of six months; whereas the *Kans* clumps in the control pots irrigated fortnighly with plain water maintained with usual vigour

*Rottboellia myurus* Benth. yields fairly a good fodder and its root-system is so fibrous that it has been possible to check soil erosion by growing them on slopes of drains. Besides, its eradication—if desired—is very simple indeed because it has no underground rhizomes like the pernicious *kans*.

## 34. Effect of a second Transplantation of chillies seedlings on yield and longevity.

T. C. N. Singh, Annamalainagar.

Chillies constitute a crop strictly raised by transplantation. In the present experiment they were transplanted a second time on the tenth day after the expiry of the first transplantation. The results briefly are:

(a) Induction of earliness in flowering and fruiting.
(b) Enhanced yield to an extent not less than 25%.
(c) Induction of an extended period of longevity.

## 35. Effect of C.M.U. and T.C.A. weedicides on Kans (Saccharum spontanium).

R. J. Kalamkar *and* R. B. Ekbote, Madhya Pradesh.

The paper deals with the effect of C.M.U. and T.C.A. weedicides on Kans (Saccharum spontanium). The application of C.M.U. even at the rate of 20 lbs. per acre dissolved in water has been found to be appreciably effective in killing kans. The other chemical, T.C.A., has not been found to be effective. Further work is in progress.

Information is also furnished on the distribution of kans roots (stolens) in lands remaining follow over different periods and in different soil depths. It is observed that kans infestation is greatest on lands remaining fallow under five years and it decreases as the fallow period increases and that most of the kans roots are confined to the first foot depth of the soil. As much as 115 maunds fresh roots of kans per acre were unearthed in the first foot depth of soil in the most heavily kans infested area.

## 36. Locust visitation of Orissa in 1951.

G. C. Sengupta *and* B. K. Behura, Cuttack.

A brief account of the visitation by the desert locust *Schistocerca gregaria* (Forsk.) together with the extent of damage done in Orissa in June, 1951 is given. The swarm consisted of immature stages only. They fed on food-crops as well as cultivated and forest trees viz: *Shorea robusta, Eugenia jambolana*

## 37. The red palm weevil and its control.

K. K. Nirula, J. Antony *and* K. P. V. Menon, Kayangulum.

The red palm weevil *Rhynchophorus ferrugineous F.*, is a very serious pest of coconut palms in India, The damage is done by the larvae, which bore into the tender positions of the stem, and quite often destory the growing point. Palms of all ages are attacked, but younger palms 4 or 5 years old are most susceptible.

The life history of the palm weevel has been studied. Total duration of life cycle from oviposition to emergency was from 59 to 120 days, with a mean average of 82 days.

In laboratory trials with various insecticides against the full grown larvae of *Rhynchophorus ferruginous* F., feeding on the soft portions of the coconut crown in glass jars, 1% Pyrocone E, Killoptera, 1% BHC, 1% Toxaphene and 1% Paris green gave good results. In trials against the larvae previously established in the stems of screwpine and coconut palm, 1% Pyrocone E, and Paris green were more effective than the others. Against the adult weevils, 1% Pyrocone E and Killoptera were found better than the rest. Killoptera being volatile gave good results in the laboratory trials, but due to its poor diffusion through the plant tissues and lack of residual effect, it gave poor results in the field trials. Pyrocone was quite effective in controlling the pest in large scale field trials.

## 38. Comparative studies with some organic insecticides in relation to the control of termites.

K. K. Nirula, J. Antony *and* K. P. V. Menon, Kayangulum.

Termites are a serious pest on the coconut palm at all stages of its development, the maximum damage being caused to the young seedlings in the nurseries. An attempt was made to find a suitable soil poison for the control of the subterranean termites, responsible for damaging nursery seedlings.

Laboratory trials with dry soil, treated with some organic insecticides, were carried during 1951 and 1952. Jars of treated soil were periodically infested with workers of termites, found in the coconut nurseries, and the reactions of the insects were recorded. Outstanding toxicity was exhibited by Parathion in very light dilutions. Pentachlorophenol and sodium pentachlorophenate were also quite effective. BHC showed rapid and complete toxicity to the termites in the first trials, but subsequently its insecticidal properties were found waning. Toxaphene held up fairly well, but was not as toxic as BHC. Chlordane, DDT and DDD were insecticidally active against the termites in the treated soils, but were slow in action. Although Pentachlorophenol and sodium pentachlorophenate were less toxic than Parathion, they had all the other characterestics of a good soil poison, for the control of subterranean termites.

## 39. Two decades of field trials in India with *Trichogramma* against the sugarcane stem borer, *Argyria* sp. and the root borer, *Emmalocera depressella*.

E. S. Narayanan *and* P. B. Mookherjee, New Delhi.

In India some field trials have been made with the parasite, *Trichogramme evanescens minutum* Riley during the last 2 decades for the control of sugarcane stem-and-root-borers. Exploratory field trials made during the first decade gave encouraging results. The subsequent trials made during the second dacade on an all India basis in field experiments have proved that the parasite is beneficial in Madras, Bombay, Orissa and Bihar, where the damage caused by the borers has been checked resulting in the increase in the yield of cane. The data obtained from other centres were rather too erratic to come to a definite conclusion.

The question of success or failure of this parasite has been a matter of controversy all over the world. Our recent investigations in the field trials made so far show that at least three important factors viz. (a) superparasitism in the mass rearing of the parasite resulting in emergence of no or weak progeny (b) lack of host abundance in the field and (c) the ecological adaptibility of this parasite are to a great extent responsible for the so called failures of the parasite in some of the centres. Our laboratory studies in respect of the last factor have further shown that this parasite would not work well if the temperature of the field where liberations are to be made is lower than the optimum temperature of the field at which the parasite is bred on a mass scale in the laboratory (86°F). When such transferance of parasite is effected under these fluctuating temperatures, it has been observed that its longevity and fecundity are significantly decreased. It has also been observed that slightly higher temperature prevailing in the field than the optimum temperature of its breeding in the laboratory (86°F) are favourable for its liberations.

Great caution is, therefore, necessary for the mass breeding of this parasite and their liberations in the field.

## 40. The hazard to man and domestic animals by modern insecticides.

R. S. Srivastava *and* H. M. L. Srivastava, U.P.

The use of any insecticide on wide scale must be preceeded by a thorough study of its toxicity to man and domestic animals. In case an insecticide is harmful to human health, great care and precautions are needed in its application to avoid hazards. The hazards may be occurring at different stages e.g., in the manufacturing plant, in the home, in formulation and mixing, in field application and finally in the consumption of contaminated goods. The precautions and care to avoid these hazards have been described. The hazards to man and domestic animals by modern insecticides such as DDT, BHC, Parathion, Chlordane, Aldrin and Dieldrin have been discaussed.

## 41. Persistence of modern insecticides under Indian field conditions. Part I:–Persistence on maize and castor plants.

S. Pradhan *and* P. B. Mookherhee, New Delhi.

There has been a rapid addition to the list of new organic insecticides during recent years. All these insecticides are of foreign origin and little authentic information exists about their suitability for or adaptability to Indian requirements. The superiority of these modern insecticides over the earlier ones lies mainly in (a) their characteristic of acting both as contact and as stomach poison and (b) their capacity to persist for considerable periods even under field conditions. Naturally this latter property is very much influenced by the climatic conditions of any particular place.

A series of field sprayings were carried out with emulsions of DDT, gamma BHC, Parathion, Chlordan, Aldrin, and Dieldrin on maize and castor plants and the toxicity of the leaves of these treated plants was determined after different intervals. It was observed that the effect of 1% & 2% emulsions of DDT on castor plants as indicated by *Euproctis* larvae as the test insect persisted for about 41 days during January–February despite a rainfall of about 0.11″ during the second week after spraying; 0.25% & 0.125% Dieldrin emulsions persisted upto 19 days; but after that observations could not be continued, the effects of 0.5% & 0.25% emulsions of Aldrin, BHC, and Chlordan and 0.125% of Parathion were lost in about two weeks time under similar conditions.

In another experiment with maize leaves sprayed with 0.125% & 0.25% Dieldrin emulsions and locust hoppers used as test insects, it was observed that Dieldrin persisted even beyond 41 days during July–August despite a rainfall of about 8″ giving 100% mortality in 2 days as against 25% mortality in the control. Emulsions of Chlordan (0.125% & 0.25%) and Parathion (0.0625% & 0.125%) tried with Dieldrin were not effective beyond a week under similar conditions.

Further work on these lines is in progress.

## 42. Persistence of modern insecticides under Indian field conditions. Part II:–Persistence in Sugarcane and Cotton crops.

S. Pradhan *and* R. A. Agarwal, New Delhi.

The present paper reports the results of investigations on the persistence in sugarcane and cotton crops in the field and on muslin cloth both in the field and in the laboratory of 19 different formulations formed from six basic insecticidal chemicals viz., DDT, BHC, Chlordane, Aldrin, Parathion and Toxaphene.

As expected, a good deal of variation was met with in the case of plant surfaces under the field conditions. These variations were, however, considerably reduced when muslin cloth was used instead of plant surfaces and controlled conditons in the laboratory were substituted for the uncontrolled field conditions. Despite these variations, the following general trends were observed:–

(a) The persistence of the same insecticide was detected for different periods when different species were used as test insects. Obviously the more susceptible test insect detected the toxicity for a longer period.

(b) The persistence of the same insecticide in the same crop differed from season to season.

(c) When cloth pieces treated with insecticides were exposed separately (i) to sunlight for a total period of 134 hours during 53 days and (ii) to total darkness during all these 53 days the deterioration was generally greater in the former case.

## 43. Studies on the distribution and sampling of insect pests.

S. Pradhan *and* S. K. Prasad, New Delhi.

Precision experiments were carried out with eight species of insect pests. On the basis of the experiments the following tentative conclusions are reported:

1. Out of the different shapes and sizes tried for different species the following proved to be the best :

   (a) four feet elongated along the rows for *R. pseudobrassicae* Davies. *M. persicae* Sulz. and *M. excavatus* Dist.

   (b) three feet elongated along the rows for *Pyrilla* speceis.

   (c) eleven feet elongated along the rows for sugarcane borers (*S. neivella* Fab., *A. sticticraspis* Hamp and *E. depressella* Swin. together) and

   (d) four contiguous plants for *C. zonellus* Swin.

As all the possible shapes and sizes were not yet tried it is possible that these conclusion may be modified later.

(2) The optimum percentage of the population to be sampled and corresponding recision for the different insect species were determind.

As the spatial heterogeneity existing in different directions in the field was not taken into consideration, is likely that the results may have to be modified later on.

(3) Sampling zone was found to be fairly suitable for estimating the population of *R. pseudobrassicae* avies and out of five chemicals studied, ethyl ether was found to be the best for separating the mustard aphids from the plants surface.

(4) Correlation between the yield of jowar grain and the incidence of *C. zonellus* Swin. was worked out. The best fitting regression equation was found to be

$$X_1 = 6.204\,X_4 - 0.925\,X_3 - 27.17$$

where in $X_1$ = yield in gms., $X_3$ precentage of length infested, and
$X_4$ = number of ears.

## 44. On some aspects of insect desiccation.

S. Pradhan *and* G. I. D'Souza, New Delhi.

This paper reports the results of investigations on the following different aspects.

(a) *Rate of desiccation of 3rd to 4th instar nymphs of Periplaneta americana under three different physiological conditions, viz., fed, starved and dead and under 5 different humidities.*

In these studies the rate of desiccation was found to be least in the case of starving insects and generally highest in the case of dead ones. (These observations are being reported for the first time and they contradict certain views expressed by previous workers). Considering insect in the same physiological state, the rate of desiccation was generly higher at the lower humidities with certain exceptions.

(b) *Determinations of normal water content in a total of 32 insect stages belonging to 19 species:*

These studies indicated that there is a wide variation in water content of the different insects studied; the lowest being in the case of dealated swarming adults of *Microtermes obesi* and the highest in the case of the larvae of *Papilio demoleus.* The water content in the different stages of *Schistocerca gregaria* progressively decreases from the 1st stage to the adult stage, there being a sudden decrease in the water content from 5th stage hopper (73.67%) to the adult stage (55.35%).

(c) *Body weights at the time of death of 14 different stages in insects belonging to 9 species kept under 7 different humidities:*

These studies have added a number of fresh examples in support of the following principles which have been enunciated before but which have not yet been finally settled.

(i) *Rapid rate of desiccation bringing about death earlier than slow desiccation to a greater extent.*

(ii) *Smaller individuals dying earlier due to desiccation than larger ones.*

This principle was enunciated by earlier workers on the basis of size differences in different species which might be differing in so many other factors too, but during the present studies it has been clearly established separately in 11 different insect stages each time using individuals of the same stage and of the same species showing only individual variations in size.

(iii) *Potentiality to augment depleted water content by coverting solid matter of the insect body into metabolic water:*

It has been possible to calculate the approximate amount of solid matter of the insect body consumed during starvation under different humidities.

## 45. Comparative toxicity of different modern insecticides against some Indian crop pests.

S. Pradhan *and* J. M. Satpathy, New Delhi.

The paper contains the results of a series of experiments designed to study the relative susceptibility of five species of Indian crop pests to some modern insecticides. On the basis of graphically determined values of m.l.d. the order of toxicity of different insecticides was as follows;

(1) *Oxycarenus laetus* K.

(a) 24 hours after treatments:–Parathion>BHC>Aldrin>DDT>Lethane.

(b) 48 hours after treatments:–Parathion>BHC>Aldrin=DDT>Lethane.

(2) *Rhopalosiphum pseudobrassicae* Dav.

(a) 24 hours after treatments:–Parathion > BHC > DDT > Chlordan > Lethane.

(b) 48 hours after treatments:–Parathion > BHC > DDT > Aldrin > Chlordan > Lethane.

(c) 72 hours after treatments:–Parathion > BHC > Aldrin > DDT > Chlordan > Lethane.

(3) *Drosicha* (*Monophlebus*) *stebbingi*

(a) 144 hours after treatments:–Parathion > BHC > Aldrin > Chlordan > DDT.

(4) *Bagrada cruciferum* F.

(a) 18 hours after treatments:–Parathion > BHC > DDT > Aldrin > Chlorda.

D (b) 36 hours after treatments:–Parathion > BHC > Aldrin > DDT > Chlordan.

(5) *Pyrilla* Spp.

(a) 26 hours after treatments:–Parathion > BHC > DDT > Aldrin > Chlordan.

(b) 50 hours after treatments:–Parathion > BHC > Aldrin > DDT > Chlordan.

(c) 74 hours after treatments:–Parathion > DDT > BHC > Aldrin > Chlordan.

### 46. Susceptibility of different stages of Locust (*Schistocerca gregaria* F.) to insecticides.

S. Pradhan *and* Abdullah, New Delhi.

First to fourth instar nymphs of *Schistocerca gregaria* F. were dusted separately with different concentrations of gamma BHC, toxaphene and aldrin. Dusting was carried out with the help of a precision dusting apparatus (Pradhan and Srivastava-1951). The M.L.D. doses were calculated for the different stages on the basis of both actual and adjusted mortalities on 1st, 2nd and 3rd day after application of the dust. The following tentative conclusions are being reported:–

(i) The median lethal dose increases for successive instars. In other words the susceptibility of the successive instars decreases from 1st to 4th instars.

(ii) As the interval between the application of the insecticides and the assessment of mortality increases, the differences in susceptibilities of different instars become more clearly pronounced in the case of gamma BHC and toxaphene and gets less clearly pronounced in the case of aldrin.

(iii) To 1st and 2nd instar nymphs the order of toxicity was gamma BHC > aldrin > toxaphene.

(iv) To the third instar nymphs, both aldrin and gamma BHC appeared to be of equal toxicity 24 hours after application but later on after 48 and 72 hours aldrin proved to be more toxic.

(v) To the fourth instar nymph gamma BHC appeared to be more toxic than aldrin after 24 and 48 hours but again aldrin proved to be better than gamma BHC after 72 hours.

### 47. Shearing Strength of Soils in Relation to the Nature of Base in clay.

K. Subba Rao *and* P. S. Talwar, Delhi

The shearing strength is an important property of soils from the point of view of trafficability and foundation engineering. The magnitude of the shearing strength is dependent upon the mechanical composition of soil i.e., the percentage of sand, silt and clay. The effect of change of the base in clay on the shearing strength of soil has been studied and the results are presented in this paper. The gangetic aalluvial soil of Delhi was employed for the study. The soil samples were treated separately with 0.5 molar solutions of the following stalts:–Sodium carbonate, Calcium chloride, Magnesium chloride, Barium chloride and Aluminium chloride. The treated soils were washed and allowed to dry in air. With the advance of drying, the moisture and shearing strength of soils were determined at regular intervals of time. The results indicate that for any particular value of soil moisture, Aluminium soil develops the highest shearing strength and the Sodium soil the least. The shearing strengths of the soils of Barium, Magnesium, Calcium and also the natural soil are in the decreasing order.

## 48. Variation in Soil Porosity with the Temperature of Dehydration of Soil.

K. SUBBA RAO nad P. T. RAMACHARUL, Delhi

Study of the effect of the temperature of dehydration of soil on its permeability during prolonged submergence of the soil inwater indicates that soil on dehydration at temperatures above 60°C. shows a progressive increase in non-capilalary porosity. It is suggested that as the soil is sjubjected to dehydration at high temperatures there is aggregation of the soil particles into bigger ones. In order to verify the existence of this aggregation mechanism, the total porosity in dehydrated soils was found out by determining the real and apparent densities. The capillary porosity according to Zunker is twice the hygroscopicity and the hygroscopicity of a soil is according to Mitsche lick is the soil moisture at 94.3% elative humidity. The water served by the dehydrated soil at this humidity and 35°C. was found out by employing the quartz fibre spring balance. Knowing the total porosity and the capillary porosity, the non-capillary porosity is calculated. The results indicate that with the increase in the temperature of dehydration of soil, the total po osity in the dehydrated soil progressively increases, and the capillary porosity decreases. The non-capillary porosity therefore increases. This increase in non-capillary porosity is in correlation with the increase in permeability observed. This correlation is in accordance to the non-capillary porosity theory of soil permeability.

## 49, Effect of the Removal of Organic Matter on the Permability of Dehydreted Soils.

K. SUBBA RAO and S. K. WADHAWAN, Delhi

When the normal soil is dehydrated at high tempe atu es, it has been shown that the permeability of the dehydrated soil of water progressively increasew with the temperature of dehydration. The effect of the removal of oçganic matter from the soil on the permeability va iations has been studied and the results are presented in this paper. Organic matter is removed from the soil by oxidation by hydrogen peroxide. The oxidised soil was dehyd ted at different temperatures and the permeability of the dehydrated soil was measured. The results indicate that at different temperatures the oxidised soil always shows a lower permeability than the normal soil. Excepting for the decreased permeability of the oxidised soil, the general characteristics of the permeability co efficient-Time curves are the same for both normal and oxidised soils

# 40th INDIAN SCIENCE CONGRESS, LUCKNOW 1953

## SECTION OF PHYSICS

PRESIDENT : DR. N. R. TAWDE, Ph.D. F. Inst. P., F.N.I.,

## *Abstracts*

### 1. Motion of a sphere through a viscous liquid

D. V. GOGATE & K. R. CHAUDHURI, Baroda.

In this paper a simple laboratory method for determining the exact position of the plane at which a solid sphere falling through a liquid column attains its terminal velocity is described. A theoretical relation based on Stoke's law is then derived between the terminal velocity $V_t$ attained by the sphere and the time $t_0$ taken by the latter to attain that velocity after leaving the free surface of the liquid at the top of the column. It is shown that for a solid sphere of mass $m$, the time $t_0$ is given by:—

$$t_0 \sim \frac{m}{m^1} \frac{V_t}{g}$$

$$\text{where } m' = m - \frac{4}{3}\pi a^3 \rho$$

$a$ being the radius of the sphere and $\rho$ the density of the liquid used.

Experiments carried out with solid spheres of different sizes and different masses and also with different liquids clearly indicate that the agreement between the derived formula and the experimental results is quite satisfactory. A number of graphs illustrating the above points are also appended.

### 2. Rise of Water in a Soil.

H. N. PATIL, Visnagar, (N.G.).

In this paper, an attempt is made to study the rise of water in a column of soil under different pressures. It is found that the rate of rise of water in a soil depends upon the pressure to which the soil column is subjected. The rise is faster when the applied pressure is less than the atmospheric pressure and becomes slower and slower as the applied pressure exceeds the atmospheric pressure.

When a solution of ammonium sulphate is tried in place of water, it is found that the rise of the solution in the soil column is inversely proportional to the applied pressure. An increase in the concentration of the solution is found to have the same effect on the rate of rise as the increase of pressure. The various graphs showing the rise of water and of the ammonium sulphate solution, in the soil columns clearly illustrate the effect of varying pressures and concentrations.

## 3. A wind survey for wind power

M. W. CHIPLONKAR & M. L. NANDGAONKAR, Poona.

In recent years a growing interest is being shown all over the world with regard to the problem of wind as a source of cheap electric power; and with this aim, wind surveys have already been carried out in the U.S.A. and Great Britain. In order to overcome the unsteady character of the power derived from wind at any one place, it has been suggested that the diversity of wind with respect to time and place could be utilised by setting up a net-work of wind power stations distributed all over a tract of more or less permanently favourable wind-fields, and to feed the individually generated power directly into the already existing electric power grid system over that region. With that end in view, the authors have carried out a detailed wind survey over a large selected region, covering the western and central parts of India. It is found that the total wind movement over the whole of this region shows, irrespective of the direction, a regular and stable pattern of annual cycle, with a sharp maximum in June-July and a flat minimum around November-December. The minimum movement being only about 70% and the maximum movement about 165% of the long period annual average. However, from the analyses of both the long period data and also the typical one year data (March 1949 to March 1950) for the selected 48 stations, distributed over this region, it has been shown that there exist in the Bombay State and the neighbouring districts of Hyderabad sufficiently large tracts over which such a net work of distributed wind power stations would give large and more or less steady wind power. The time and space diversity analyses and also the "energy pattern factors" calculated for each station lying in these tracts have been found to support these conclusions. These points are clearly brought out in the numerous tables and figures accompanying this paper.

## 4. A synoptic study of Ocean Swells associated with a cyclone in the Bay of Bengal.

S. BASU *and* U. K. BOSE, Poona.

A synoptic study of the ocean swells generated by a cyclone in the Bay of Bengal during 7th and 11th Dec. 1951 has been undertaken. These swells, it has been reported, caused considerable dislocation of normal working at the affected ports with some amount of damage also. Hence the case attracted a good deal of publicity.

A few recorded cases of notoriously destructive cyclones, in the Bay of Bengal have been referred to. In one of these, the sea was rough and swell heavy even when the cyclone was more than 150 miles away; while in the other cases the height of the storm wave was of the same order of magnitude as the height of the swell waves reported by two ports in the Dec. 1951 cyclone.

A rough estimate of the heights of the 'significant waves' near the ports caused by this cyclone was made with the help of the 'Practical Graphs for use in Forecasting Significant Wave Heights etc.' developed at the Scripps Institution of Oceeagraphy, University of California. The estimated heights are found to be of the same order of magnitude as the significant wave heights observed at the ports and reported by ships plying in their neighbourhood at the time. It was found that the available observations of the wave period, wave length and wave heights and also the wind speed, during this period, were anything but adequate for any quantitative study. This clearly indicates that there is an immediate requirement of an all round increase in the quantity and improvement in the quality of the observations of ocean swells by ships as well as at the coastal stations in India.

A brief summary of the theoretical study of ocean waves has been added, and the technique of recording ocean waves, specially by means of the wave recorders installed in England during the Second World War have been briefly reviewed with a view to indicating the suitability or otherwise of using these methods at the Indian coastal stations.

## 5. The swelling and aggregation of colloidal particles during the sol-gel transition of lyophilic gels.

P. K. Katti, Delhi.

Main results of an extensive investigation on the sol-gel transition of a few lyophilic and lyophobic gels by the R. S. Krishnan colloid optical technique have been discussed. The values of the depolarisation $\rho_v$ and $\rho_h$ and the total intensity, $I_z$ of the transvesrly scattered light have been measured at various intervals during the sol-gel transition. From the corresponding values of $I_z$ and $\rho_v$ the density scattering $I_\delta$ has been calculated by using the formula $I\delta = I_z \frac{3-4\rho_v}{3\times 3\rho_v}$ and $I_\delta$ —time, diagrams showing the variation of density scattering with time during the sol-gel transition have been prepared. The following conclusions have been arrived at, regarding the growth of the colloidal gel particles during the transition. For the lyophobic gels, during the earlier stages $\rho_v$ increases with the increase in the size and the $I\delta - t$ curves show distinct points of maxima indicating the formation of anisotropic aggregates.

In the case of the lyophilic gels we have three distinct stages, (1) At first only the increase in viscosity starts with no change in the size and shape of the particles. The values $\rho_h$ and $\rho_v$ which are very sensitive to the changes in the size and shape of the particles remain unaltered even after the viscosity has changed appreciably indicating that during this stage the particle tends to develop a cloud of water molecules which sorround it without however actually entering its structure.

(2) In the next stage the increase in the size starts as shown by the continuous decrease in the value of $\rho_h$ . $\rho_v$ continuously decreases and the density scattering increases continuously without showing any tendency to reach a maximum. Gels with particles large enough to give $\rho_h = 80\%$ have been obtained showing no maximum value of $I\delta$, indicating that the growth of the particles in this case may be due to the swelling of the individual particles by some of the sorrounding liquid entering its structure by a sort of osmosis.

(3) Finally $\rho_v$ begins to increase and $\rho_h$ contiuues to decrease further until the gel sets. If this type of increase starts during the earlier stages then very distinct points of maxima can be obtained long before the value of $\rho_h$ decreases to 80%, indicating the aggregation of the swollen particles.

The physical properties of the set gel depend upon the relative preponderance of the three stages during the transition, which themselves depend upon various factors such as temperature, concentration, electrolyte content etc. of the gel.

## 6. Intermolecular force constants from Transport properties and second virial coefficients.

B. N. Srivastava *and* M. P. Madan, Lucknow.

The thermal diffusion data on argon and other gases have been examined on the basis of the Lennard-Jones 12;6 potential energy function, and combined with the viscosity and self-diffusion data to yield the intermolecular force constants $t$ and $\gamma_0$. It has been found that with increase of temperature $t$ increases while $\gamma_0$ decreases, and this variation has been explained theoretically. From these the force constants and λ have also been evaluated and are found to vary with temperature, the former increasing while the latter decreasing with rise of temperature. These variations have also been accounted for theoretically and are shown to be in accord with the experimental data on the second virial coefficients of argon.

## 7. Thermal diffusion of gas mixtures and forces between unlike molecules.

B. N. SRIVASTAVA *and* M. P. MADAN, Lucknow.

The Chapman-Enskog formulae for thermal diffusion in a mixture of gases have been utilized to interpret the data on several gas mixtures at different temperatures but having the same composition. Assuming the Lennard-Jones 12:6 potential for unlike molecules also, the force constant $t_{12}$ for interaction between two unlike molecules has been calculated form the temperature dependence of the thermal diffusion ratio $k_T$. These determinations are expected to provide the most accurate value for this interaction, as thermal diffusion is far more sensitive to the lews of interaction, than the other transport properties which have been hitherto used to estimate $t_{12}$. The force constant $\gamma_{12}$ is calculated from the experimental data on inter-diffusion coefficient $D_{12}$ by utilising these values of $t_{12}$. Thus $t_{12}$ and $\gamma_{12}$ are determined purely from experimental data. Equations have been developed to correlate $t_{12}$ and $\gamma_{12}$ with $t_{11}$, $t_{12}$ and $\gamma_{11}$, $\gamma_{12}$, and these relations have been tested with the help of the experimental values. It is found that our theoretical relations give much better agreement than the hitherto assumed geometric mean relation for $t$ and the arithmetic mean relation for $\gamma_0$. Equations have also been developed for $\mu_{12}$ and $\lambda_{12}$ and their theoretically obtained values compared with the experimental results.

## 8. Making of Bi-prism.

A. O. MATHAI, Trivandrum.

One side of the pair of identical rectangular glass plates of which the bi-prisms are to be made are ground & polished as usual. They are then turned up side down and mounted side by side with wax on a truely fine ground glass disc, the edges which are farther away being tilted up by keeping straight wires of uniform section in a direction parallel to the edges. The gauge No. of the wire and the distance at which they are kept from the opposite edges are precalculated to give the required angle of tilt. Half the area of either plate is thus ground and polished. The plates are then reserved and the process repeated over the remaining halves and a pair of Bi-prisms are obtained.

## 9. The Near-Ultraviolet absorption sepectrum of 3-chloropyridine.

VETURY RAMKRISHNA RAO, Waltair.

The absorption spectrum of 3-chloropyridine in the near ultra-violet was studied with a three meter grating using a path of 75cm tube. About 104 bands were measured from all the spectra corresponding to various vapour pressures obtained by varying the temperature of the reservoir. The bands were divided into two systems: transition *I* with 0.0 at 2870.4 A.U. and transition II with 0,0 at band at 2740.7 A.U. Bands in transition *I* are strong and line-like while those in *II* are weak and diffuse. A study of the solution spectra gave a value of 0.0009 for the oscillator strength of the molecule. The following frequencies are tentatively suggested in transition *I*: 151, 254, 614, in the lower state and 126, 209, 245, 274, 500, and 727 in upper state. Work is in progress to obtain Raman data to aid in a more complete analysis of the spectrum.

## 10. Ultraviolet absorption Spectra of p-dichloro-and p-dibromobenzene in the liquid and solid states at different temperatures.

S. C. SIRKAR *and* H. N. SWAMY, Calcutta.

The ultraviolet absorption spectra of *p*-dichlorobenzene and *p*-dibromobenzene in the liquid state have been photographed and compared with those for the substances in the solid state at different temperatures, in the case of *p*-dichlorobenzene in the liquid state at 60°C, only three broad bands at 35342, 36387 and 37430 $cm^{-1}$ are observed, the intervals being about 1044 $cm^{-1}$. When the liquid is solidified at 30°C, the solid film gives three broad bands at 35558, 36584 and 37611 $cm^{-1}$, the intervals being about 1026 $cm^{-1}$. When the crystalline film is once cooled to —180°C and brought to 30°C again, six bands having smaller width are observed. The three new bands correspond to the interval 764 $cm^{-1}$ forms the principal bands. The absorption spectrum of the solid film at —180°C shows bands which are very sharp and besides the $\nu_0$ band at 35593 $cm^{-1}$ and a progression for the vibrational frequency 1052 $cm^{-1}$, other fainter bands corresponding to vibrational frequencies 569, 737 and 1249 $cm^{-1}$ are observed.

In the case of *p*-dibromobenzene in the liquid state at 90°C, only four broad bands at 35260, 36268, 37280 and 38292 $cm^{-1}$ are observed. On solidifying the thin film at 30°C, these bands shift to 35362, 36380 37400 and 38420 $cm^{-1}$ respectively, but their width does not change appreciably. These bands do not undergo any change when the crystal is once cooled to —180°C and brought again to 30°C. When, however, the crystalline film is cooled to —180°C the bands become sharper and extra bands appear as in the case of *p*-dichlorobenzene. These bands correspond to the combinations of vibration frequencies 329, 537, 693, 1004, 1202 and 1431 $cm^{-1}$ with the $\nu_0$ band.

It is concluded from these results that intermolecular field in the liquid and solid states have great influence on the electronic energy level of these two molecules and the angular oscillations of the molecules at room temperature broaden the absorption band so much that the fainter bands are not resolved from the intense bands. At —180°C, the amplitudes of angular oscillation diminish to small values and so the fluctuation of intermolecular field diminishes greatly. The absorption bands become sharper for this reason and the feeble bands are thus distinctly separated from the intense bands. The difference in the behaviour of the two crystals once cooled to —180°C and again brought to room temperature is also explained by assuming the crystal structures to be different from each other.

## 11. Spectro-chemical Study of Potato and Wheat Plants.

P. PARASURAMIAH, J. D. RANADE *and* D. R. BHAWALKAR, Sagar.

The presence of certain elements in traces in plants has been now well established and the important role played by these trace elements in plant physiology has been well recognised. So far chemical methods have been used for the study of trace elements in soils, agricultural products and garden products. The spectorscopic technique has not been as yet applied to the study of this type of examination, except for one reported in the Ind. Jour. of Physics. The spectrum of the ash of (i) Potatoes, leaves and roots of the Potato Plant and (ii) Wheat, Husk and Wheat Plant, has been studied along with that of the soil of the field in which they were grown. The Potato Plant and the Wheat Plant were taken from the same field.

The major elements present in the ash are Ca, Mg, Al, K, and Fe. The lines of Mn, Mo, Cu, Cr, Co, Si, Sr, B, and Be are also found; from the intensities of the lines the latter series of elements may be considered as the trace elements. A comparision between the proportions of some of the elements present in potatoes, wheat leaves, wheat seed, and wheat husk, is given. Except for Si, and Mg, wheat ash shows the presence of the remaining elements to the extent of half the quantity as compared to potato. Exact quantitative work is still in progress.

## 12. Influence of Oxygen on the first and second positive system of Nitrogen.

K. S. KORGAONKAR *and* N. R. TAWDE, Bombay

1(P) and 2(P) band systems of nitrogen have been excited in a wide bore $\pi$ type tube using a 50 cycle transformer discharge. Peak intensities of about 15 bands of 1(P) system in the visible region and of about 35 bands of the 2(P) system in the visible and ultra violet region have been measured under six different cases, first in pure nitrogen, secondly in four different mixtures of $N_2$ and $O_2$ in proportions 95:5, 80:20, 50:50 and 5:95 respectively and lastly in air, by photographic photometry technique and under the same conditions of excitation and pressure. Intensity distribution in $N_2$-$O_2$ mixture as well as in air has been compared with that in pure nitrogen and certain conclusions have been drawn regarding the role of oxygen in the development of 1(P) and 2(P) systems of $N_2$ in a discharge through air.

## 13. Comparative study of $C_2$ (Swan) Bands in discharge through Different Rare Gases.

V. RAJESWARI, Bombay.

The $C_2$ (Swan) bands have been excited in discharges (carbon electrodes) through different rare gases with a view to study the relative efficiency of the gases in the production of the system. The bands have been examined at various pressures between 1 mm. and 30 mm. of Hg. and have been found to undergo a selective excitation in all the gases, (except He) at a particular pressure characteristic of the gas used. The value of the critical pressure is found to be lowest for Xe and highest for Ne. From the results of this study it is thought that the $C_2$ molecule is probably formed by the dissociation of CO according to $2CO \longrightarrow CO_2 + C$, and by the combination of the carbon atoms leading to the formation of $C_2$. The molecule is then excited by slow electrons in the discharge plasma. Attempts have been made to explain the relative efficiency of the gases and their role in bringing about the selective excitation in terms of the discharge mechanism and the critical potentials of the gases.

## 14. Spectral Differentiations in Alcohol Flame Radiations.

B. B. LAUD, *and* N. R. TAWDE, Bombay

A number of new problems have arisen lately in the field of combustion spectroscopy. The evidence as to the energy equilibrium of the vibrational rotational and translational degrees of freedom in molecular radicals needs to be sought on a larger scale in order to form some idea of the mechanism of combustion processes. In this context the problem of alcohol flames has been tackled in this laboratory. The technique of stabilization of these flames has been improved and data on the characteristic spectral differences in the ethyl-alcohol flames at various air-fuel compositions have been recorded.

## 15. Comparative Study of Theroretical and Experimental Transition Probabilities of $N_2$ 2(P) System in Nitrogen-Argon mixtures.

D. D. DESAI, Bombay.

The subject of band spectra has shown, of late some notable advance in regard to wave-mechanical theories of transition probabilities. Earlier theory due to Hutchisson for a simple harmonic oscillator has been found inadequate to predict the transition probabilities in real cases. Attempts have been made by Gaydon and Pearse, Pillow and Bates to take into account the anharmonicity in the molecule by different approaches. It was thought, therefore, desirable to see how far the different theories agree between themselves and with the experiment. For this purpose, Bates' data for $N_2$ 2(P) system has been extended to cover 18 more bands. Experimental results of transition probabilities of $N_2$ 2(P) system in nitrogen-argon mixtures obtained lately by us have been used for comparison with other available experimental data and to test the different theories. It has been shown that Bates' values are comparatively in better agreement with the experimental values than the other theoretical data.

### 16. Direct Measurement of spectral intensities by photo-multiplier tube.

G. K. METHA *and* R. D. JOSHI, Bombay.

A set-up for the direct measurements of intensities with an electron multiplier photo-tube has been described. The electronically regulated power supply with the potential dividing net work for the RCA 931A, nine stage multiplier has been constructed and used for the purpose. The multiplier is used in conjunction with a Fuess monochromator for the measurement of intensities in the spectra of some sources. The response of the multiplier for the different wave-lengths has been precisely determined by the use of a standard ribbon filament lamp with known energy distribution. The idea underlying these investigations is to compare the relative intensities of the lines in some sources with those found by photographic photometry which has been so far extensivley used in these laboratories.

### 17. *The Transfer of Radiation in Atmospheres with spherical sysmmetry and in non-conservative cases.*

K. K. SEN, Chandernagore.

The equation of transfer of radiation in spherically symmetric atmosphere in which scattering is isotropic and nonconservative. has been solved in the first approximation. The external condition assumed is no radiation incident on the surface from outside. The source-function and other properties of the radiation field have been obtained. The case of a star placed in a weak radiation field has been specially considered. The outer boundary is fixed by the condition that the inward and outward fluxes are the same, while the inner boundary is taken as the bottom of the photosphere. The variation of the ratios of the outward fluxes of radiation at the inner and other boundaries with optical depth has been worked out. The results are shown in a table. The method of treatment followed is that of Chandrasekhar, in which integrals are replaced by the corresponding Gaussian Sums.

### 18. "X-ray Studies of Hyderabad Clays.

IFTHIKAR AHMED SIDDIQI *and* SULTANA Z. ALI,
Hyderabad Deccan.

X-ray studies of Hyderabad clays have been undertaken to determine the mineralogical composition as earlier work, which comprises of chemical analyses and physical tests and the ceramic behaviour, fails to give a clear idea as to the mineralogical nature of the clays and the impurities.

X-ray power data is presented on the clays from the five major deposit in the State, viz., at Kamthana (Bihar) Shekhapur, Pachegaon, Srirangapur and Chintriyal. The results so far obtained show that all the clays except the Chintriyal clay are close enough to a typical fireclay in the crystallographic sense. Their exact position in the series kaolinite-fireclay—metahalloysite is under investigation. Kamthana clay is quartz—free compared to the Shekhapur, Pachegaon and Sriranga-pur clays which have appreciable quantities of this mineral. The clay from Srirangapur gives the prominant lines of montmorillonite and felsper as well, and other impurities in this as well as the other clays are under investigation.

Chintriyal clay powder diagram shews the lines due to quartz and mica quite prodominantly. The rest of the lines are weak and the clay mineral diagram if present at all, is too feeble to help in identification. The absence of the 7A° line indicates that after preferred orientation studies of the finer clay fractions have failed to prove the existence of the 7A° line and the other prominent lines of the kaolin group, the clay will have to be regarded as consisting of amorphous silica and alumina in addition to mica, quartz and other crystalline components.

## 19. Studies in Electrets Part 2"

C. S. Bhatnagar *and* D. R. Bhawalkar, Sagar.

Electrical conductivity of Carnauba wax is found out at temperatures near about its melting point. It is known that for preparing an electret from Carnauba wax, it has to be heated upto its melting point between tin electrodes. The steady current conductivity from about 70°C to 90°C was determined, care being taken to see that the entire mass of the wax was in thermal equilibrium. From the variation of conductivity with temperature, it appears that the wax shows linear characteristics of a solid insulator upto about 70°C while above this temperature the rise in conductivity is more rapid. This rise is most rapid between the temperatures 78°C to 82°C, which is also the range of temperature to which the wax has to be heated to get good electrets. For temperatures above 82°C the wax is in a molten condition and shows a break in the ($\sigma$, T) curve. The conductivity relations are those of a liquid dielectric above 82°C, but the slope of the curve after 82°C is less than that of the curve between 78° and 82°C. The ($\sigma$, T) relations were measured for Fatty Gray, Refined Fatty Gray and Prime Yellow, the three varieties of Carnauba Wax available in the market. The conductivity decreases with refinement in the Wax, being lowest for Prime yellow, about 1/10th of that for Fatty gray. The conductivity was also studied for its dependence on the electric field by using D.C. Voltages from 20 Volts to 5 Kilovolts. In the case of Fatty Gray Wax, which is commonly used for preparing electrets, in general, there is a lowering of the value of $\sigma$ as the field is increased. The break at melting point is more sharp at higher fields for Fatty Gray, while it is quite sharp for all Voltages for the refined varieties.

## 20. "Siudies in Electrets Part 3"

C. S. Bhatnagar *and* D. R. Bhawalkar, Sagar.

The electrical conductivity of Fatty gray carnauba wax was measured at different electric fields using tin electrodes and keeping the temperature constant. Measurements were taken for temperatures from 75°C to 90°C. The wax behaves as a solid insulator for temperatures upto about 78°C. The ($\sigma$, T) relation shows that it is neither a solid nor a liquid from 78°C upto about 82°C, when it melts. In the molten condition it behaves as a liquid dielectric. The relation between the conductivity $\sigma$ and voltage plotted for various constant temperatures shows certain peculiarities which are common to all curves. At a constant temperature, the conductivity depends on the electric field, and it varies with field in a non-linear fashion. The variations are particularly more marked in the low voltage region. There is a distinct maximum value of conductivity at about 150 Volts field for all states of the wax and a minimum at about 50V. For Voltages from 1 kilo-volts to 5 kilo-volts, the curves at different temperatures show three distinct characteristics (i) Upto about 78°C, $\sigma$ is constant (ii) between 80° & 82°, the curve shows another maximum at about 3 KV and (iii) for temperatures about 82°C (Molten wax), the curves show an increase in $\sigma$ with field after 3 Kilo-volts. These relations along with the relations obtained previously (part 2) clarify a good many peculiarities of the behaviour of Carnauba wax as the basic material for the preparations of Electrets.

## 21. Probe Method for High-Frequency Discharges.

### G. K. MEHTA, Bombay.

It has been shown earlier that for probe measurements in h.f. discharges one extra electrode has to be introduced as anti-probe (Ap) to serve as a reference point with respect to which the potential of the probe (P) is varied. The characteristic obtained by such arrangement is influenced by the change in potential at Ap which does not serve as a true reference point. As a result of this, the semi-log plot (log i-V) only comes out approximately linear for small values of the probe current. This fact introduces uncertainty in the value of the mean electron energy (electron temperature) derived from this curve. Proper considerations of the working of the system containing P and Ap, show that the usual method of interpreting the characteristic cannot be used in such cases. A new approach to the problem has been suggested and experiments have been carried out which show that the probe method with the improved method of interpretation and calculations can be successfully applied to h.f. discharges for the determination of the mean energy of the electrons.

## 22. On the Variation of the rest-mass of Electron in the field of Electo-magnetic waves.

### N.D. SENGUPTA, Bombay

In the attempt to study rigorously the scattering of the electromagnetic-waves by unbound-electron, with an exact solution of Dirac equation for the electron, in the field of monochromatic electromagnetic wave, $a \cos \{\nu (N, x)/h\}$, following Klein-Nishina (Zets. f. Physik-52, 1929), one arrives at the following scattering condition

$$p+N_\nu=q+N'_\nu{}'+\frac{Ne^2}{4c^2}(a.a)\left\{\frac{1}{(p.N)}-\frac{1}{(q.N)}\right\} \quad \cdots \quad \cdots \quad \cdots \quad \cdots \quad (1)$$

where $p$, $q$, $N\nu$, and $N'\nu'$ are the energy-momentum four vector for the incident electron, recoil electron, incident photon, scattered photon. But for the term in $e^2a^2/m^2{}_0c^4$, it is the wellknown Debye-Compton condition. A rational physical interpretation can be given to this, paying regard to the extra term, if one admits that the energy-momentum four vector of the electron in the presence of the electromagnetic waves is changed to $P$ from $p$ given by

$$P=p-\frac{Ne^2\,(a.a)}{4c^2\,(p.N)}\ ; \qquad Q=q-N\,\frac{e^2\,(a.a)}{4c^2\,(q.N)} \quad \cdots \quad \cdots \quad \cdots \quad (2)$$

So equation (1) takes the form

$$P + N_\nu = Q + N'_{\nu'} \qquad \text{..} \qquad \text{..} \qquad \text{..} \qquad (1')$$

The equation (2) leads to the fact that the rest-mass ($m$) of the electron in the field of radiation, is changed from that of the free-electron ($m_0$, in the absence of the field) given by the relation

$$m. = m_0 \left\{ 1 - \frac{e^2\,(a.a)}{2m_0^2c^4} \right\}^{\frac{1}{2}} \qquad \text{..} \qquad \text{..} \qquad \text{..} \qquad \text{..} \qquad \text{..} \qquad (3)$$

## 23. Relative Cross-sections of $(n,p)$-Reactions in Sulphur 32 and Phosphorous 31

N. K. SAHA *and* M. CHOUDHURY, Delhi.

Fast neutrons from a 100 milligram (Ra+Be)-sources have been used to produce $(n, p)$-reactions in $S^{32}$ and $P^{31}$. The radioactive end products of the reactions $P^{32}$($T\sim$ 14.3 days) in the case of S and $Si^{31}$($T\sim$170 min.) in the case of P, serve as indicator of the reactions. By the principle of 'threshold detector', the initial radioactivity of the end product in each case is a measure of the average cross section of the $(n, p)$-reaction over a narrow band of neutron energy between the threshold of the reaction and the upper limit of the effective neutron energy for capture. The initial activities are measured under strictly comparable geometry of irradiation and detection taking a saturation layer of the well-mixed active subtance in cylindrical paper shells and placing a thin walled Geiger-Mueller counter co-axially inside. The saturation conditions are found out by elaborate preliminary experiments. The initial activity, measured in this way, comes out to be 367 counts/2 mins. for S and 240 counts/2 mins. for P. Various corrections for chemical or isotopic composition of the sample, self absorption of $\beta$-rays, non-saturation of activity etc. are applied. The relative cross section of $(n, p)$ reaction for $S^{32}$: $P^{31}$ is finally obtained as $\sim$2 with a probable error of about $\pm 10\%$. This agrees reasonably well with the ratio $\sim$2.37 obtained by Cohen with much higher energy of fast neutrons. Importance of work on these lines for the interpretation of high excitation states of nuclei is discussed.

## 24. Cross Sections of $(p,2n)$, $(p, pn)$ and $(p, 2p)$ Reactions for Copper Bombarded with High Energy Protons.

S. N. GHOSHAL *and* T. N. DAVE, Lucknow.

A general expression for the cross section of a nuclear reaction involving the emission of $n$ successive particles after the bombardment of the target nucleus with a suitable projectile has been developed. The possibility of emission of various types of particles, like protons, neutrons, etc. in each stage has been considered. The general equation has been applied to the cases of the emission of two and three particles respectively in a nuclear reaction. The explicit expressions for the cross sections in these two cases have been given. The energy region of the bombarding particle is assumed to be such that the compound nucleus hypothesis holds good.

Cross sections have been calculated, based on the equations derived, for $(p, 2n)$, $(p, pn)$ and $(p, 2p)$ processes on $Cu^{63}$ upto the incident proton energy of 22 Mev. Weisskopf's statistical theory of nuclear reactions has been applied to carry out the numerical calculations. The results have been compared with the experimentally determined cross sections for $(p, 2n)$ and $(p, pn)$ processes on $Cu^{63}$. The calculated values of $\sigma$ $(p, 2n)$ are found to be about fifty percent higher than the observed ones. The disagreement is however much more violent for $\sigma$ $(p, pn)$ where the calculated values are found to be only about one-fourth of the measured values at $Ep = 22$Mev. The ratio $\sigma$ $(p, pn)$: $\sigma$ $(p, 2n)$ is calculated to be about 0.6 at the maximum energy of the incident proton considered, as against the value 4 for the same ratio as determined experimentally in the same energy region. The possibility of the proton and the neutron being emitted as a single deuteron in the $(p, pn)$ process has also been considered. Its effect is, however, found to be very small upto the incident proton energies considered. It seems that the simple picture of the evaporation of nucleons from the excited nucleus, which forms the basis of these calculations, does not hold in the case of proton emission in the present case.

## 25. Beta Spectrometer Studies of the Radiations from Isotopes Produced by Bombardment of Silver with $\alpha$-Particles

S. N. Ghoshal, Lucknow.

$\beta$ and $\gamma$-radiations emitted by several radioactive isotopes produced in silver by the bombardment of $\alpha$-particles from the 60-inch cyclotron of the University of Califormia have been studied by means of a magnetic lens $\beta$-ray spectrometer. A new $\gamma$-ray lime of energy 203 kev with a period of 3 to 5 hours is assigned to In$^{109}$ produced by Ag$^{107}$ $(\alpha, 2n)$ reaction. The assignment is made by measuring the excitation function of the yield of this $\gamma$-ray line by the help of the spectrometer. A 660 kev $\gamma$-ray line with a comparable period seems to belong to the well known Cd$^{107}$ isotope of 6.7 hours half life produced by Ag$^{107}$ $(\alpha, p3n)$ reaction. The assignment in this case also is made by measuring the excitation function. Since this reaction takes place only at high $\alpha$-energies, its excitation function will be superposed on that of In$^{109}$ of comparable period (5.2 hrs) at higher $\alpha$-energies. This is probably the reason why the excitation function of the latter shows the abnormal behaviour of not going down to low values at higher $\alpha$-energies as it normally should, due to the competition from other reactions which set in at higher $\alpha$-energies only. This abnormal behaviour of the excitation function of In$^{109}$ was reported in an earlier work of the present author.

Besides the $\gamma$-rays discussed above, the continuous positrons were also studied. A new positron activity of 0.9 Mev end-point is assigned to In$^{109}$. This assignment is made by noting the relative yields at $E_\alpha = 21$ Mev and 37 Mev respectively. The yield at the lower $E_\alpha$ was much higher. Another positron activity of 2.2 Mev end-point is also assigned to the same isotope In$^{109}$.

## 26. A Ring of Monastable Multivibrators as a generator of a continuous sequence of square waves.

U. C. Gupta *and* R. Prashad, New Delhi.

A number of monastable multivibrators are connected in the form of a ring and it is arranged that if a voltage wave is developed at any one multivibrator of the ring, the trigger obtained at the end of the wave by differentiating the latter, is of the right polarity and amplitude to trip the succeeding multivibrator. The latter multivibrator in its turn, will develop a wave of time-width governed by its own circuit parameters. Thus starting with all the multivibrators in their normal, quiescent states once an initiating trigger is applied to any one of them, the multivibrators will be continuously tripped in succession.

The ring can be used as (1) a commutator Switch, a generator of a sequence of waves or pulses of independently adjustable time width and time-delay between them. Due to the multivibrator ring starting functioning by means of an initiating trigger, it can be used for remote control. The ring action can be stopped electronically, by applying a blocking trigger to a multivibrator in synchronism with the firing trigger being applied to this multivibrator from the preceding multivibrator. Due to this property, the ring circuit can act as a memory device, and a delay device, both of indefinite and definite time-delay.

## 27. Photographic study of Periodic Fading with Medium-Wave Radio Signals;

Dharambir Rai *and* S. R. Khastgir, Banaras.

With signals of medium wave lengths from the three A.I.R transmitting stations (Lucknow, Patna and Allahabad), Photographic records of the periodic fading patterns were obtained in the early night hours when the receiver was worked with the suppressed-ground wave aerial-system. The receiver employed was a superhet set with the A.V.C. made inoperative and with a suitable minor galvanometer inserted in the balanced anode circuit of the second detector valve. The galvanometer deflections were recorded photographically on a rotating drum system. The following types of periodic fading were observed:

(i) 'Slow' Periodic fading
(ii) Comparatively 'Quick' periodic fading
(iii) Superposed type
(iv) Occasional 'Flutter' type of rapid fading.

The observed periodic fading of 'slow' period is definitely attributted to the interference of the ordinary and extra-ordinary components of the wave in the ionosphere in the manner described by Appleton and Beynon. Photographic records taken with an aerial system for the selective reception of one or the other of the two magnetoionic components showed complete absence of 'slow' periodic fading, while similar records with a single loop aerial revealed the 'slow' periodic patterns. The comparatively 'quick' periodicity which was observed in the records taken with the selective aerial-system and with a single loop aerial is considered to be due to the vertical movement of the ionosphere. Considering the "Doppler-beat" effect between the singly and doubly reflected waves from the E-layer, it was found that the vertical velocity of the ionosphere obtained from a number of these patterns was of a small order which can be compared with the vertical velocity due to tidal oscillations. Some of these patterns however indicated a large value for the vertical velocity of the ionosphere which may be attributed to 'winds' set up in the ionosphere due to meteors.

The cause of the 'flutter' type of very rapid fading occasionally observed with medium-wave radio signals is under investigation.

## 28. Ocsillographic Study of Intensity Variations of short-wave Radio Signals

S. G. Lele, *and* S. R. Khastgir, Banaras.

Instead of having a mirror galvanometer in the anode circuit of the second detector valve of a superhet receiver, the rectified output voltage from the second detector valve was amplified (when necessary) and applied to one pair of the deflecting plates of an oscillograph so that the fluorescent spot of light moved in accordance with the variations of the signal intensity. A suitable filter system was used across the deflecting plates to eliminate the A/F variations due to different depths of amplitude modulation during the broadcast programmes. With the help of a lens-system, a sharp point-image of the fluorescent spot of light was obtained on the bromide paper round the rotating drum of the recording system.

Short wave signals from six distant broadcasting stations in India and Pakistan were received at Banaras and the intensity variations recorded in the above manner.

The Appleton-Beynon type of periodic fading was observed in various records. The Doppler-beat type was also identified in many periodic patterns. The vertical velocity calculated from these periodic patterns ranged from 1.0 to 4.7 metres/sec. As the vertical component of the tidal drift of the F-layer is of the order of 3 metres/sec in the evening hours over the latitudes of Banaras or Calcutta, it is considered likely that the tidal movement is the origin of these periodic fading patterns of the Doppler-beat type.

The observed quick periodic patterns which could not be due to the interference between the upper and lower trajectory rays in the ionosphere were attributed to the regional high vertical velocity of the ionosphere. From the observed values of the *quasi*-frequency, the computed vertical velocity was found to have a wide range from 9 metres/sec to 170 metres/sec. These velocities may be caused by the passage of meteors in the ionosphere.

Karachi signals on 25 metres and Colombo signals on 26 and 42 metres gave the '*flutter*' type of rapid fading with a mean frequency of 3.6 cycles/sec.

From the random fading records,the *variability* of fading was measured.

## 29 Measurement of phase difference between the voltage across the discharge tube and the current in the discharge tube.

B. R. MARATHE, Banaras.

Phase difference measurements between the current in a discharge tube and the voltage across it, were carried out with a cathode-ray oscillograph. Below $V_m$ the current is capacitive and leads the voltage by approximately 80°. At potentials above $V_m$, the current consists of two components viz., the capacitive current which is approximately 80° out of phase and the conduction current which is in phase with the voltage.

The current pulses appear when the voltage is slightly less than the peak value. No pulses appear when the voltage is decreasing in the a.c. cycle. This appears to be due to a rapid decrease in V before enough space charge is removed from the gap.

When the current in the discharge tube increases, the voltage across it drops down momentarily to a lower value.

## 30. Joshi Effect in Se-Se Vapour under Sleeve Excitation.

H. J. ARNIKAR, Banaras

Earlier work of the author showed that both positive and negative Joshi effects are producible in an evacuated ozonizer with a fine film of selenium deposited on the glass walls. Residual gas in such a system being of a very low pressure ($10^{-3}$ mm Hg), the Joshi effect therein is presumably associated mainly with the conductivity of the surface layer. Present work covers results of *surface* excitation of the photosensitive film over the potential range of 0.25—6.0 *kV* (r.m.s., 500~ frequency).

The current in the system in dark due to a constant applied potential changed with time continuously (increasing at low and decreasing at high potentials) till a steady value was reached at the end of about 10 min. Irradiation of the system at this stage by ordinary light from a 200-watt bulb resulted in immediate suppression of the current, followed by a slower decrease that tended to a constant in about 5 min. On cutting off the light, the current rose again slowly, the final current being somewhat less than the original steady value in dark. At 2.75 $kV$ (r.m.s., 500~ frequency), to quote a typical case, $i_{\rm Dark}$ fell from 170 to 90$\mu$ A in 4 min. and was steady. On irradiation $i_{\rm Light}$ began falling rapidly at first and more slowly later to a limiting values of 33$\mu$A, reached in about 10 min. On screening off the light, $i_{\rm D}$ reached a final value of 85$\mu$A. The nett suppression under light ($i_{L\ \rm steady} - i_{D\ \rm steady}$) corresponds to 50-60% negative Joshi-effect, whose characteristics are compared with the Joshi effect normally producible.

## 31. Some observations on Joshi Effect in Iodine Vapour under 'Silent' electrical discharge:

S. R. KHASTGIR *and* P. S. V. SETTY, Banaras

Some experimental results with Iodine Vapour at saturation pressure inside a discharge tube fitted with external 'sleeve'-electrodes and excited by varying voltages of 50 cycles/sec are given in the paper. The results have shown two distinct types of current pulses in iodine vapour under 'silent' electrical discharge. The oscillographic evidence strongly suggests that the two types are of different origin. The observed positive Joshi effect near the 'threshhold' potential is attributed to the initiation of what have been called the *Townsend pulses* by the incidence of light and the observed negative Joshi Effect is considered as *mainly* due to the photo-suppression of what have been called the '*discharge*' pulses. The experimental results confirm the view regarding the origin of the 'discharge' pulses. An account is also given of parallel sets of experimental results on Joshi Effect observed by directly measuring the discharge current and also by detecting in a radio receiver the *R/F* oscillations as modulated by the A/F pulses in the 'silent' discharge. It is considered likely that the physical processes in the theory of Joshi and in the photo-dissociation theory of Harries and Von Engel are operative under suitable experimental conditions, quite apart from what has been formulated in the paper.

## 32. Origin of R/F oscillations in a/c 'silent' discharges.

S. R. KHASTGIR, *and* C. M. SRIVASTAVA, Banaras

An electronic theory of the origin of the R/F oscillations in a/c 'silent' discharges is given in the paper. According to Loeb and Meek's streamer theory when the applied field is adequate for Townsend's cumulative ionization, there is a conical distribution of positive ions drifting towards the cathode. In an a/c 'silent' discharge, the negative charge formed on the intervening glass surface attracts the positive ions of the conical column and forms a stationary array of positive ions close to the glass surface. A gap is also set up initially between this array of positive ions and the upper surface of the streamer by the time the latter touches the glass wall on the cathode side. This gap is subsequently bridged up when the density of the charge on the glass surface attains a requisite value producing what has been called a Townsend pulse. Before this requisite density is formed, the gap exists and electronic oscillations of the Barkhausen-Kurz type are set up near the glass surface opposite to the anode. These oscillations are maintained till the gap is bridged up. Accordingly we get R/F oscillations which are maintained intermittently, each train being followed by a Townsend pulse.

The theory explains the general features of the R/F oscillations observed in a/c 'silent' discharges. The effects of light and heat on the frequency of such oscillations are also explained.

## 33. Streamer Mechanism in A/C 'silent' discharges in relation to Joshi Effect.

S. R. Khastgir, *and* C. M. Srivastava, Banaras.

The streamer mechanism of Leob and Meek, as applied to A/C 'silent' discharges is developed in the paper. According to the streamer theory, when the applied field is adequate for Townsend's cumulative ionization, there is a conical column of positive ions drifting towards the cathode. In an A/C 'silent' discharge, the negative charge formed on the intervening glass surface attracts the positive ions of the conical column near the anode and forms a stationary array of positive ions close to the glass surface, producing thereby an electrical double layer. A gap is also set up initially between the array of positive ions and the streamer by the time the latter touches the glass wall on the cathode side. A discharge is not, therefore, possible at the time due to this gap. It has been explained how this gap is subsequently bridged up, when the density of the charge on the glass surface attains a requisite value producing what has been called *Townsend pulses* at the peak values of the applied A/C field. The discharge (or discharges) across the electrical double layer on and near the glass surface in the manner suggested by Mitra gives rise to a different types of pulses. Such pulses have been called *'discharge' pulses*. That the two types of pulses exist, atleast in certain gases, is substantiated by the experimental results of Khastgir and Setty. In iodine vapour, there is experimental evidence to show that the critical voltage for the occurrence of the Townsend pulses is distinctly less than that for the occurrence of the 'discharge' pulses.

The effect of light on the two types of pulses has been considered in detail and the following conclusions have been drawn:

(i) Initiation of the Townsend pulses by irradiation may be possible under favourable conditions. This explains the *positive* Joshi Effect observed near the threshold potential in certain gases

(ii) At or near the 'threshold' potential, complete suppression or reduction of *either* type of pulses may be caused by irradiation.

(iii) In iodine vapour, the negative Joshi Effect is largely due to the disappearance or reduction of the 'discharge' pulses.

(iv) The physical processes underlying Joshi's theory or the photo-dissociation theory of Harries and von Engel may be operative under suitable conditions, quite apart from what has been formulated in the paper.

## 34. A Possible Mechanism of Hydrogen Bomb.

Saiyid Shamim Ahmed, Aligarh

Difficulties of holding the atom bomb together are pointed out if hydrogen is to be brought to the temperature of the Sun by the slow conduction process. It is submitted that hydrogen must be present in close proximity of the fissing uranium atom. This condition is satisfied by $UH_3$. Plutonium must form a compound of the same type. The study of $PuH_3$ will be very interesting as hydrogen atoms will reduce neutron velocities and hence will reduce the critical size of the bomb. $UD_3$ and $PuD_3$ as also the tritium compounds will be still more full of dangerous possibilities. The same mechanism may enable controllable release of atomic energy by condensation process to be effected. A study of similar Thorium compounds should be undertaken to investigate the possibility of controllable release of atomic energy from this easily available source.

## 35. Use of coincidence technique for obtaining decade and other scaling ratios from binary flip-flop counters.

R. Prashad *and* A. Sagar, New Delhi.

Coincidence technique has been used to modify binary scalers for obtaining any scaling ratio, in particular the decade.

The coincidence technique as applied here, consists essentially of use of diodes whose cathodes are conductivly coupled to some tube-plates of the scaler, and whose anodes are tied together and returned to H.Y. through a series resistance. As the tubes associated with the coincidence system in the manner above, get non-conducting, in the course of application of input triggers, a positive trigger is obtained at the common anode terminal of the diodes. At some subsequent count, as one of the above tubes becomes conducting, a negative coincidence trigger is obtained. These triggers can be used to cause transitions of the states of some of the stages of the scaler, this fact being equivalent to an advance of count. An advance of count by six units in a four stage scaler (of unmodified scaling ratio 16) makes the latter a decader.

Another use of the coincidence technique is to stabilise triple-bridge decade-type inter-polation, which taken by itself is much more critical in circuit setting than the double bridge interpolation.

To date, about a dozen new decade schemes have been developed, almost all of which have the speed of the binary counter and have decade-type interpolation.

## 36. Joshi Effect in Maze Counter type Discharge Tube.

M. R. Bhiday, V. G. Bhide and V. G. Asolkar, Nagpur.

The production of Joshi Effect (± Δ i) in various systems excited in full ozonisers has been reported earlier by the authors (Proc. Ind. Sci. Congr. 1950, 1951, 1952). The present investigation deals with the study of Joshi Effect in various systems excited in Maze counter type tubes and its variation with exciting potential, intensity and hardness of the X-ray beam.

The Joshi Effect obtained at several pressures (3 to 128 mm. Hg.) in hydrogen, chlorine, methane etc., excited in Maze counters has the variation almost similar to that reported earlier for these systems excited in full ozonisers in respect of exciting potential, intensity and hardness of the X-ray beam. Generally below $Vm$, the threshold potential, X-ray irradiation causes a reversible increase of the discharge current accompanied by the production of current pulses. As $Vm$ is approached, the positive Joshi Effect falls precipitously and shows a transition $+\Delta i \rightarrow -\Delta i$ at about $Vm$. A similar transition at a given V can be obtained by the increase of intensity and hardness of the beam. The negative Joshi Effect observed above $Vm$ increases with V to a maximum just above $Vm$ and then decreases with a further increase of $V$.

The intensity variation of $-\%\ \Delta\ i$ shows the existence of optimum intensity. This optimum intensity is determined by the nature and concentration of the excited medium and also the hardness of the beam. The variation of $-\%\Delta i$ with hardness shows, however, an increase to a constant maximum.

C.R.O. studies show a slight asymmetry of the current structure in both the halves of the current cycle. This is possible due to the asymmetry of the electrode system. The positive Joshi Effect is revealed in the form of production of current pulses while the decrease in amplitude and at times an increase in the number of pulses is associated with negative Joshi Effect.

These results are explained on the basis of an extension of Joshi's theory to the role of positive ions.

## 37. The Exploding Planets

SHIVA KISHORE, Lucknow.

Starting from the origin of planets from an exploding supernova, the author has postulated the concentration of heavy elements at the centre of the planets due to gravitational selection and liberation of energy due to rearrangements of matter according to density.

The various aspects of the formation of a nuclear-reactor have been analysed. The possibility of more favourable conditions for the formation of a reactor, at the heart of the planets, has been dealt with. The different type of reactors possible in different planets has been investigated. The possiblity of the reactor getting regenerative has been examined and the explosion of the mother of Aestroids proved.

Special attention has been given in the case of earth. The formation and regeration of the reactor, the fizzling out of the explosion, the creation of density inversion, the motion of this low density ball to the surface, the hump formation and its explosion aided due to earth's spin have all been dealt with. A correction has been made, in the age of the earth as calculated by Jafferies, in view of this explosion and birth of the moon.

On this basis, the origin of only one continent Pangaea, continental drifts, formation of mountain chains, the presence of volcanoes round the Pacific and other places, the double hump graph of the height and percentage of the earths surface, the polar drifts, the origin of mineral deposits and specially the high concentration of radioactive minerals at the skin surface of the earth and the barren age of the earth has been proved.

All the surface features of the moon have been explained.

In the end assurance has been given, that this earth is a spent bullet and will not explode again and all the fissile matter has come to the surface for our peaceful use.

## 38. Influence of external magnetic field on *Joshi Effect* in nitrogen

C. SRIRAMAMURTI *and* M. V. RAMANAMURTI, Banaras

Studies on the influence of magnetic field (H) on *Joshi Effect* in nitrogen at the optimum pressure *viz.*, 20 mm Hg in full-ozonizers and tubes with external sleeve electrodes, have been made. 50~potentials (0.2 to 2.5 kV) and H (200–1000 gauss) are used.

Threshold potential, $V_m$ is not altered by the application of H. Discharge current ($i_D$), at a fixed V, in ozonizers decreased rapidly to a minimum on application of low H (about 400 gauss); a further increase of H, however, increased it. In sleeve tubes, $i_D$ decreased continuously with an increase in H. Negative Joshi Effect, ($-\Delta i$) occurs at $V > V_m$ and is increased to a maximum with a rise of V; large applied V, however, disfavoured it. Magnetic field (H) decreases the numerical value of $-\Delta i$ in sleeve tubes; the decrease is more marked at large values of H and low voltages. In ozonizer discharges, however, $-\Delta i$ is not affected by magnetic field.

## 39. Effect of the Activator on the Luminescence of Ca S-Bi Phosphor

### R. K. SHRIVASTAVA *and* D. R. BHAWALKAR, Sagar

The role of activator in luminescence in ionic crystals is now well understood qualitatively according to the theory of Mott & Gurney ("Electrons in Ionic Crystals") The quantitative verification however is besot with numerous difficulties. Ca S-Bi phosphors were prepared by reducing gypsum with Carbon at a high temperature (800°C.) in a muffle furnace in reducing atmosphere. Bismuth was used as an activator. It is known that the proportion of bismuth for good intensity of Phosphorescence has to be within certain narrow limits. In the present series of experiments, assuming that all the gypsum has been reduced to Ca S, the % of Bi activator with respect to Ca S was varied between 0.000576 and 0.001596. Sodium Fluoride and Photographers Hypo were used as fluxes and their proportions were kept constant. The method of mixing and powdering, temperature and duration of heating were all kept constant for each sample. It was found that the intensity of afterglow changes with the % of the activator. However, the change is not linear, but even in the narrow limits chosen, the intensity of afterglow as determined visually and the corresponding proportion of Bismuth, show a periodic variation, though the intensity in general increases with the amount of the activator, upto a limit and then gradually falls.

## 40. Effect of temperature of Firing on the Phosphorescence of Ca S-Bi Phosphor

### RAJA MADHAV RAO *and* D. R. BHAWALKAR, Sagar

In exciting Phosphorescence in ionic crystals the activator atom occupies an interstitial position and electron traps are created. It is necessary to heat the sulphides of alkaline earth to a certain temperature to introduce the activator atom in the crystal lattice. A mixture of gypsum and carbon was used as the material to get Ca S, and the usual fluxes, Na F & Photographers hypo in very pure form, were used along with a definite proportion of Bi. The methods of mixing and powdering were kept the same and the proportions of flux and Activator were also kept the same. The temperature of firing however was varied from 500°C. to 850°C., and the duration of heating from ½ hour to 6 hours, whenever necessary. It is seen from about 80 different samples prepared that certain minimum temperature is necessary to excite phosphorescence. Samples fired at lower temperatures and not showing phosphorescence appeared. The intensities of afterglow as judged visually showed a regular dependance on the temperature of firing and duration of heat treatment.

## 41. Applications of Electronics to Airnavigation and Meteorology

### SACHINDRA NATH BOSE, Barrackpore

In the first half of the paper Radio direction finding aids for aircrafts have been discussed. Latest trials about airborne Radar equipment for detecting storms etc., have also been discussed in some details. In the second half of the paper, Ground Radio method for locating storms as is used in U.K. has been studied and some limitations of the method are pointed out. As regards the radar echoes from rainfall, perfect coincidence has been achieved between theoretical and experimental results. The experimental technique has been discussed fully.

# 40th INDIAN SCIENCE CONGRESS, LUCKNOW, 1953

## SECTION O MATHEMATICS

PRESIDENT : V. V. NARLIKAR

## *Abstracts*

### 1. The Square Triangular Matrix with Unit Elements.

N. M. BHATT, Baroda.

. The square triangular matrix $T$, with unit elements along the principal diagonal and below it and zero elements above it, is introduced and its reciprocal matrix is obtained. The general forms of the matrices $T^r$ and their reciprocals are then obtained as triangular matrices. Next is considered a matrix $TXT'$, X being a diagonal matrix with elements $x_1, x_2, \ldots, x_n$, along the diagonal and its reciprocal is obtained as a continuant matrix. Finally the elementary and the complete homogeneous symmetric, functions of degree $j$ in the arguments $x_1, x_2, \ldots, x_n$, denoted by $a_j$ and $h_j$ are expressed in matrix notation as $x'(TX-X)^{j-1} X^{-1} x$ and $x'(TX)^{j-1} X^{-1} x$, $x$ being the column matrix $\{x_1 \, x_2 \ldots . x_n\}$.

### 2. A Theorem on Matrices Analogous to Fermat's Theorem.

A. R. ANSARI, Aligarh.

In the note the following theorem is proved:

*Theorem*:—Let $p$ be an arbitrary prime, $\alpha$ any arbitrary positive integer, I, the Unit Matrix of order $n$, $B$ a square matrix of order $n$ such that $B^2 \equiv I \pmod{2p}$

then $$B^{2p^{\alpha-1}} \equiv I \pmod{2p^{\alpha}}$$

*Corollary*:—

Let A be a square matrix of order $n$ snch that $A \equiv I(\mathit{mod}\ 2p)$ and let $\alpha$ be any arbitrary positive integer, then

$$A^{p^{\alpha-1}} \equiv I \pmod{2p^{\alpha}}.$$

Three suitable examples are given.

### 3. A Note on certain Nilpotent Matrices.

S. M. SHAH AND A. R. ANSARI, Aligarh

Let I be the unit matrix of order $n > 1$, $k$ an integer greater than $1, A \equiv [a_{ij}]$ be a square nilpotent matrix of order $n$, index 3 and with elements $a_{ij}$ of the form $Q/2^P$ where $Q$ and $P$ are integers (positive, negative or zero) and $2P < k-1$ and $B$ a square nilpotent matrix of order $n$, any index $s > 1$ and with elements in $F$, the field of complex numbers. If $X$ and $Y$ be two matrices such that all elements of $X-Y$ are (integer) multiples of $k$ then we will write $X \equiv Y \pmod{k}$. We prove

*Theorem* 1:—If $\{2(I+A)\}^k \equiv 2I \pmod{k}$, then $k$ is a prime or a pseudoprime and conversely.

*Theorem* 2:— If $f(x)$ be any polynomial with scalar cofficients belonging to $F$, then the characteristic root of $f(I+B)$ is $f(1)$ with multiplicity $n$.

(ii) If $D$ be any square nilpotent matrix of order $n$ with elements in $F$ and satisfies the condition

$$D\{I+kB+\frac{k(k-1)}{2!}B^2+\ldots.+\frac{k\ (k-1)\ ..\ (k-s+2)}{(s-1)!}B^{s-1}\}=0$$

then the characteristic root of $\{2(I+B)\}^k+D$ is $2^k$ with multiplicity $n$.

## 4. On the Total strength of Hypergeometric Methods.

S. K. Basu, Calcutta.

In a previous note (Science Abstract, 1950) some hypergeometric methods for summing a sequence to $+\infty$ were considered by the author. In the present note some more cases have been discussed which include among others the questions of total relative strength of the two matrices $C_\alpha C_\beta$ and $C_{\alpha+\beta}$ and the total regularity of the $(H, \alpha, \beta, \gamma)$ method $(\alpha, \beta, \gamma > 0)$.

## 5. On Gap Series and Exceptional values of Entire and Meromorphic Functions.

S. M. Shah, Aligarh.

In this paper I consider gap series $f(z)=\Sigma a_{\lambda_n}\ z^{\lambda}$ and prove :

*Theorem* 1. If

$$\limsup_{n\to\infty}\frac{\lambda_{n+1}}{\lambda_n}>1$$

and if $f(z)$ be an entire function (not a constant) of finite order, then $f(z)$ cannot have an exceptional value $B$ or $E$. (For definition and main results see S.M. Shah, *Compositio Mathematica* 9(1951), 227-238).

*Theorem* 2. If a meromorphic function $F(z)$ of finite order has two values exceptional $E$ then

$$T(r,F)\sim T(r,F') \text{ as } r \text{ tends to infinity.}$$

## 6. The Maximum Term and the Rank of an Entire Function.

S. K. Singh, Aligarh.

In this paper I consider a number of problems concerning the maximum term $(\mu(r))$ and the rank $(\nu(r))$ of an entire function $f(z)$. I prove the following theorems-:—

*Theorem* 1. (*i*) If $f(z)=\sum_{0}^{\infty} a_n z^n$ be an entire function of order $\rho$ $(0 \leqslant \rho < \infty)$ and if $\phi(x)$ be any function such that $\log x = 0(\phi\ (x))$
then

$$\lim_{r\to\infty}\frac{\nu(r)\ \phi(r)}{\log M(r)}=\infty.$$

(*ii*) If the order $\rho$ be such that $0<\rho<\infty$, then

$$\limsup_{r\to\infty}\frac{\nu(r)\ \phi(r)}{\log M(r)}=\infty$$

for any $\phi(x)$ tending to infinity howsoever slowly.

*Theorem* 2. If $a$ be an e.v.B (exceptional value in the sense of Borel) for $f(z)$ then

$$\lim_{r\to\infty} \frac{n(r,x)\phi(r)}{\log M(r)} = \infty \text{ for all } x \neq a$$

and for any $\phi(x)$ tending to infinity howsover slowly.

*Theorem* 3. Let $f(z)$ be a canonical product of integral order $\rho$ and of genus $p = \rho$ and let $\frac{n(r)\,\phi(r)}{r^{p+1}}$ be bounded positively, then

$$\limsup_{r\to\infty} \frac{n(r)\phi(r)}{\log M(r)} = \infty .$$

*Theorem* 4. $\mu'(r) \geqslant \frac{\mu(r)}{r} \, \frac{\log \mu(r)}{\log r}$ for $r \geqslant r_0$.

*Theorem* 5. The integrals $I_1 = \int^{\infty} \frac{\log \mu(t)}{t^{m+1}} dt$ and $I_2 = \int^{\infty} \frac{v(t)\, dt}{t^{m+1}}$

converge or diverge together, where $r_0$ is such that $\mu(r_0) > 1$.

*Theorem* 6. If $f(z)$ has no zeros in the unit circle, then

$$\frac{M(R)}{m(r)} \geqslant \left(\frac{R}{r}\right)^{N(R)/\log R} \qquad 0 < r < R$$

where
$$N(r) = \int_0^r \frac{n(t)}{t}\, dt$$

and $M(R)$, $m(r)$, denote respectively the maximum and the minimum moduli of $f(z)$ on $|z| = R$, $|z| = r$.

## 7. A Tauberian Theorem for absolute Summability

T. Pati, Allahabad.

Let $\Sigma a_n$ be a given infinite series and $\lambda_n$ a positive, steadily increasing monotonic function of $n$, tending to infinity with $n$. If

$$A_\lambda(\omega) = A^0_\lambda(\omega) = \sum_{\lambda_n \leqslant \omega} a_n,$$

and

$$A^r_\lambda(\omega) = \sum_{\lambda_n \leqslant \omega} a_n (\omega - \lambda_n)^r \qquad (r > 0),$$

$\Sigma a_n$ is said to be absolutely summable $(R, \lambda, r)$, or summable $|R, \lambda, r|$, $(r \geqslant 0)$, provided $A^r_\lambda(\omega)/\omega^r$ is of bounded variation in $(A, \infty)$, where $A$ is a finite positive number.

The First Theorem of Consistency in the theory of absolute Riesz summability runs as follows:

Theorem A. If a series $\Sigma a_n$ is summable $|R, \lambda, r|$ $(r \geqslant 0)$, then it is summable $|R, \lambda, k|$ for every $k > r$.

The converse of Theorem A being false, in this paper is proved for absolute Riesz summability, which is equivalent to absolute convergence when the order is zero, the following Tauberian theorem, which also covers the case considered by Mohanty in Theorem C of his paper entitled "*A* criterion for the absolute convergence of a Fourier series", Proc. London Math. Soc. (2), 51 (1949).

*Theorem*. If (i) $\Sigma a_n$ is summable $|R, \lambda, k|$ $(k > 0)$, (ii) $\{a_n \lambda_n/(\lambda_n - \lambda_{n-1})\}$ is a sequence of bounded variation, and (iii) $\{\lambda_{n+1}/\lambda_n\}$ is a sequence of bounded variation, then $\Sigma a_n$ is absolutely convergent.

## 8. A Theorem on Higher Differences.

S. C. CHAKRABARTI, Calcutta.

If $(w_r w_k)_n$ denote the homogeneous expression of the $n$th degree which can be formed with $w_r, w_{r+1}, \ldots, w_k$ ($k$ and $r$ are positive integers, $k \geqslant r$) and if ${}^nR_p$ = sum of the product of $n$ numbers $w_0, w_1, w_2, \ldots, w_{n-1}$ taken $p$ at a time, then

$$\sum_{p=0}^{n} (-)^p \, (w_0 w_k)_{r-p} \, {}^nR_p = 0$$

where $n$, $r$ and $k$ are positive integers $(0 \leqslant k \leqslant n-1)$.

## 9. Some properties of Generalised Laplace Transform.

C. B. RATHIE, Bikaner.

Dr. Varma has recently given the generalization

$$\phi(p) = p \int_0^\infty e^{-\frac{1}{2}px} \, (px)^{m-\frac{1}{2}} \, w_{k,m}(px) \, h(x) dx$$

for the Laplace transform

$$f(p) = p \int_0^\infty e^{-px} \, h(x) \, dx.$$

The object of this paper is to establish a relation between the two transforms and to give a few recurrence formulae for the generalised transform. Some interesting results are also deduced.

## 10. Two Operational Relations

R. C. GUPTA, Aligarh.

The object of this paper is to obtain the operational images of

$$x^{l-1} W_{k,m}\left( x^{\nu} \right) W_{-k,m}\left( x^{\nu} \right) \text{ and } x^{l-1} K_{2\mu}\left( 2x^{\frac{1}{2}\alpha} \right) K_{2\nu}\left( 2x^{\frac{1}{2}\alpha} \right)$$

and to prove incidentally that

$$\int_0^\infty x^{l-1} \, W_{k,m}(x) \, W_{-k,m}(x) \, dx = \frac{\Gamma(l+1)\Gamma_2(\frac{1}{2}+\frac{1}{2}l \pm m)}{2\Gamma_2\,(1 \pm k + \frac{1}{2}l)}, \; R(l \pm 2m) > -1; \qquad \ldots (1)$$

where $\Gamma_2(\alpha \pm \beta) \equiv \Gamma(\alpha+\beta)\Gamma(\alpha-\beta)$.

and $$\int_0^\infty x^{l-1} K_{2\mu}(2\sqrt{x}) \, K_{2\nu}(2\sqrt{x}) \, dx = \Gamma_4(l \pm \mu \pm \nu)/\Gamma(2l), \; R(l \pm \mu \pm \nu) > 0. \qquad \ldots (2)$$

## 11. Some Identities in the Theory of Partitions.

D. P. BANERJEE, POONA.

Mordel (1922) has proved certain modular relations considered by Ramanujan, Darling and Rogers. Some new identities are given similar to a few found by Ramanujan.

### 12. The Number Infinity

M. V. Godbole.

The paper begins with considerations of linear sets of real numbers and ends with the conclusion that infinity is the largest of large numbers.

### 13. Some Properties of Rectangles of Numbers in Arithmetical Progressions.

D. R. KAPREKAR, Devlali.

A formula is given for the sums of numbers in A.P. arranged in a rectangle. Other properties of such rectangles are considered.

### 14. On some Methods for a class of Bi-harmonic Problems

B. R. SETH, Kharagpur.

It is pointed out that the first integral of a large number of boundary value problems satisfying the plane bi-harmonic equation is of the type given by Saint Venant's torsion or flexure solution for the same boundary. When the region in which the problem has to be solved has isolated singularities like concentrated loads, the problems can be readily solved with the help of the method of images, the singular points behaving like vortices.

### 15. Rotation of an Infinite Plane Lamina in a Viscous Gas.

S. D. NIGAM, Kharagpur.

The steady flow due to the rotation of an infinite plane lamina in a viscous gas has been discussed. The flow has been assumed to be isentropic and the equations have been integrated for the pressure-density relation, $p=p_0+k\rho^{\gamma}$; $(\gamma=5/3)$. The essential features of flow are the same as in the corresponding problem for an incompressible fluid. The lamina acts like a centrifugal fan. There is a steady axial flow towards the rotating lamina at infinity.

### 16. Finite deformation in the interior of the earth.

P. P. CHATTARJI, Kharagpur

Application of the finite strain theory has been made to find out the deformation in the interior of the earth considered as a self-gravitating, isotropic, heterogeneous sphere, density within which varies according to Roche's Law. Small strain theory was applied by Love to the same problem, density in which was, however, assumed to be uniform. Results of both the theories have been compared and it is found that the finite deformation theory gives the compression zone about thirteen per cent nearer to the centre.

### 17. Stress distribution in thin Aeolotropic plates.

G. PARIA, Kharagpur.

The stresses in thin aeolotropic plates have been expressed in terms of a function defined by the Fourier Transform of the stress function. The fundamental equation satisfied by the stress function is then reduced to an ordinary differential equation, the solution of which consistent with the boundary conditions leads immediately to the determination of the stresses. The following cases have been discussed in detail: (i) a semi-infinite plate with a concentrated force acting at an internal point; (ii) a strip of infinite length but finite breadth acted on (a) by a concentrated force and (b) by an isolated couple within it.

## 18. On the stresses due to a small spherical Inclusion in a uniform Beam under Uniform shearing Force.

SISIR CHANDRA DAS, Chandernagore.

The object of this paper is to find the concentration of stresses due to a small spherical inclusion in a beam under uniform shearing stress. The particular case of a perfectly rigid inclusion and that of the inclusion having the rigidity one-quarter that of the surrounding medium (steel) has been considered in detail. It may be mentioned in this connection that the case of a small spherical cavity with distribution of shearing strain at great distances from it was considered by Love (1892). The method employed here for the case of inclusion is different from that of Love and is more general.

## 19. Spherically symmetric solutions in non Symmetrical Field-Theories—I The skew-Symmetric Tensor.

P. C. VAIDYA, Vallabh Vidyanagar.

The spherically symmetric form of the skew tensor $g_{ik}$ given by Papapetrou does not give any transverse components of the electro-magnetic field. Hence a flow of radiation cannot be described by it. A more general form is found out. This necessitates a reconsideration of the programme of spherically symmetric solutions in non-symmetrical field theories initiated by Papapetrou. The present paper makes a beginning in this direction.

The new form of the tensor $g_{ik}$ is derived from a consideration of the infinitesimal rotation of a sphere about a diameter. This new form is:

$$\left| \begin{matrix} 0 & pv & -pu\sin\theta & H \\ -pv & 0 & E\sin\theta & qv \\ pu\sin\theta & -E\sin\theta & 0 & -qu\sin\theta \\ -H & -qv & qu\sin\theta & 0 \end{matrix} \right.$$

Here $p, q, E, H$ are functions of $r$ and $t$ and $u$ and $v$ are functions of $\theta$, $\varphi$ satisfying certain differential equations. One set of values of $u$ and $v$ is

$$u = \cos\theta \sin\varphi \ (1 - \sin^2\theta \sin^2\varphi)^{-\frac{1}{2}} ; \quad v = \cos\varphi \ (1 - \sin^2\theta \sin^2\phi)^{-\frac{1}{2}}.$$

It is hoped to use this form to obtain non-static solutions in non-symmetrical field theories which will correspond to solutions of a radiating star in general relativity.

## 20. A Suggestion for a modification in Einstein and Schrodinger's Unified Theory.

G. BANDYOPADHYAY, Kharagpur.

In this paper it is suggested that the field equations in the new unified theory may be modified by making the Einstein Tensor corresponding to non-symmetric affinities proportional to the corresponding components of the non-symmetric basic tensor (the four equations involving the affinities only being kept undisturbed).

Remarking on one of the author's previous work (Nature, Vol. 167, p. 648) Schrodinger (Nature, Vol. 168, p.41) asserted that according to the new unified theory an isolated magnetic pole may exist only if it has no mass. The new field equations here shows through a simple algebric equation and utilising solutions of symmetric cases of

Bonner & Papapetrou that an isolated magnetic pole can not exist at all (even if it is allowed to be massless).

Despite this advantage the field equations have certain drawbacks (which may prove to be only apparent) which are discussed in the paper.

## 21. Motion of an Ellipsoid Through A Viscous Liquid

H. G. VENKATESH, Kharagpur

Exact solutions of non-linear differential equations are almost impossible to obtain. The usual method of solving such equations in Physics by linearising them would altogether exclude from view some of the essential features of a natural process--specially the "edge effects". It is interesting to study the non-linear differential equations by a synthetic method where an *extension* of the field will give an exact solution. The synthetic method may be applied to the study of the Navier-Stokes equations of the theory of fluid flow. Here we extend the field by introducing an external force in the direction of motion of a body through a viscous liquid and solve the equations exactly. When this force is made to approach zero the method leads to the well-known solutions of irrotational and slow viscous flow of a liquid. Further it indicates the existence of a boundary layer and leads to an expression for the drag depending on the relative values of the velocity, viscosity and size of the body. The method was originally applied by B. R. Seth to the uniform motion of a sphere through a viscous liquid. Here it is extended to the motion of an ellipsoid.

## 22. Radial oscillations of Composite Models

CHANDRIKA PRASAD, Roorke.

Small adiabatic radial oscillations of a composite model, consisting of a homogeneous core surrounded by an envelope of small uniform density, are considered for a special case. It is shown that for this case the amplitude of oscillation can be expressed in terms of two hypergeometric series, one for the core and another for the envelope.

A similar solution has also been obtained for the generalised Roche's model, consisting of a homogeneous core surrounded by an envelope in which the density though infinitesimal varies inversely as the square of the distance from the centre. This solution is shown to be more general than Kopal's (*Ap. J.*, *111*, 395, 1950).

# 40th INDIAN SCIENCE CONGRESS, LUCKNOW, 1953

## SECTION OF ZOOLOGY & ENTOMOLOGY

PRESIDENT DR. N. K. PANIKKAR, M.A., D.Sc., F.A.Sc., F.N.I.

## *Abstracts*

### 1. Effect of Pyrogallol and Pyrocatechol on the meiotic chromosomes of the grasshopper, *Gesonia punctifrons.*

IRA SARKAR *and* S. P. RAY CHAUDHURI, Calcutta.

During our study of the effects of the various chemical substances on animal chromosomes, it has been observed that higher phenols such as Pyrogallol and Pyrocatechol when injected at a concentration of 0.01 M into the body of the males of *Gesonia punctifrons* yield interesting results in the spermatocyte cells.

The spermatocyte cells when examined 24 hours after treatment with Pyrogallol, show an early division of the centromeres in certain proportions of separating chromosomes at the first anaphase of meiosis. Pyrocatechol, on the other hand, gives rise to localized chromosome breakages. The breaks are confined to some of the X-chromosomes and take place very near the proximal end of the chromosome.

The possible significance of these results is discussed.

### 2. Chromosome study of fifteen species of Indian Spiders

B. N. BOLE-GOWDA, Calcutta.

This is the continuation of a programme of cytological study of Indian spiders mainly pertaining to their chromosome morphology and behaviour and their sex-determining mechanism. This paper contains the results of the study of the fifteen additional species belonging to six different families. The following table summarizes the data.

TABLE

| Species | 2n | 1st. spermatocyte | 2nd spermatocyte | |
|---|---|---|---|---|
| Family : PHOLCIDAE | | | | |
| *Crassopriza lyoni* | 27 | 13 X | 13 | 14 |
| Family : EPERIDAE | | | | |
| *Aranea feae* | 24 | 11 $X_1X_2$ | 11 | 13 |
| *Argiope pulchella* | .. | 11 $X_1X_2$ | 11 | 13 |
| Family : TETRAGNATHIDAE | | | | |
| *Leucauge decorata* | 24 | 11 $X_1X_2$ | 11 | 13 |
| Family : LYCOSIDAE | | | | |
| *Lycosa annandalei* | 28 | 13 $X_1X_2$ | 13 | 15 |
| *L. birmanica* | 28 | 13 $X_1X_2$ | 13 | 15 |
| *L. bistriata* | 28 | 13 $X_1X_2$ | 13 | 15 |
| *Lysoca sp.* | 28 | 13 $X_1X_2$ | 13 | 15 |
| *Hippasa agelenoides* | 28 | 13 $X_1X_2$ | 13 | 15 |
| *Pardosa leucopalpis* | 28 | 13 $X_1X_2$ | 13 | 15 |
| *Pardosa sp.* | .. | 13 $X_1X_2$ | 13 | 15 |
| Family : CLUBINOIDAE | | | | |
| *Castaneira zetes* | 26 | 12 $X_1X_2$ | 12 | 14 |
| *Oedignatha scrobiculata* | 26 | 12 $X_1X_2$ | 12 | 14 |
| Family : SALTICIDAE | | | | |
| *Plexippus paykullei* | 28 | 13 $X_1X_2$ | 13 | 15 |
| *Salticus sp.* | 28 | 13 $X_1X_2$ | 13 | 15 |

With the exception of *Crassopriza lyoni*, all other species have acrocentric chromosomes. This species is cytologically interesting because it has a metacentric X-chromosome which is clearly distinguishable in the spermatogonial metaphase stage. This is believed to be the first definite instance in spiders where the sex chromosome can be recognized in the spermatogonial stages. In *Lycosa* sp. and *Pardosa leucopalpis* the X-chromosomes are sometimes irregularly distributed in the first meiotic division resulting in unbalanced sperms. Univalents have also been observed in the first metaphase of some species.

## 3. Observations on the Cytology of *Thelyphonus indicus* (Stoliczka).

### M. D. Parthasarathy, Bangalore.

An outline of spermatogenesis of *Thelyphonus indicus* is given. The diploid number is 43, of which 42 are autosomes and one "X". The homologues can be easily. identified. The sex-chromosome shows hetero-pychosis during early meiotic prophase It forms an accessory plate and is placed away from the autosomes in the I metaphase. The 1st division is reductional to both autosomes and sex-chromosome. So it is an instance of pro-heterokinesis. The sex-chromosome moves towards one of the poles earlier than the autosomes a case of precession. Interkinesis is almost absent. The second division starts even before the cell-wall is formed.

The condition seen in *Thelyphonus indicus* is compared with that in *Thelyphonus sepiaris* and *Sarax sarahkawensis*.

## 4. A Preliminary note on the cytology of Melaniidae (Mollusca-Gastropoda).

### Joseph Jacob, Annamalainagar-.

The cytological investigation of five species of Melaniid including *Melania* (Radina) *orenulate* (Desheyes), *Paludomus–tanschaurica* (Gmelin) and three species of *Melanoides*, has revealed many interesting features. *Melania crenulata* has a chromosomes number $n=17+X$ and in *Paludomus tanschaurica* $n=18+XY$.

*Melanoides tuberculatus* shows diploid parthenogenesis and the chromosome number $2n=30$. Remarkable meiotic abnormalities occur in others. *Melanoides* sp. has an abnormal sex ratio with only 3% males. At first metaphase non-pairing univalents and pairing bivalents occur, which exhibit irregular behaviour and unequal distribution. Bridges and fragments are common at anaphases. The overall chromosome number is 91–93. There is thus evidence of the species being a natural hybrid and that inversions occur. Quadrivalents and higher multivalents indicate segmental interchange or reciprocal translocations. Chromosome chains and tripolar spindles are also met with. Spermatid degeneration occure widely.

*Melanoides lineatus* also shows abnormal meiosis but to a lesser degree. The high chromosome number 72–76 and other abnormalities indicate that this species also is a hybrid. Only .001% of males occur. In both the species the anamolous males do not seem to be functional. In all the species investigated atypical meiosis also takes place producing Oligopyrene sperms.

## 5. A Note on the Chromosomes of *Cacopus systoma* Cunth.

### R. Natarajan, Annamalainagar.

In the family Engystomatidae (=Brevicepitidae) the only genus whose chromosomes have been investigated *so far* is *Cacopoides tornieri* in which the number is $2n=$

28: F.N.=50. The present note describes the chromosomes of *Cacopus systoma*. The chromosome number is $2n=26$ and F.N.=50. The difference in chromosomes between *Cacopoides* and *Cacopus* consists in the presence in *Cacopus* two more metacentric chromosomes and 4 less of acrocentric chromosomes. Interlocking of four of five bivalents seems to be a regular feature in the meiosis of the male *Cacopus*. The terminalization is complete and interlocking proximal.

## 6. Non-Synchronous Segregation of Chromosomes in the meiosis of the House Mouse.

M. R. Rajasekara Setty, Bangalore.

During the studies on a new type of genetically determined variation in fertility in the house mouse (Rajasekarasetty, 1951, 1952) a detailed study of spermatogenesis in normally fertile males of the Genotypes + +, T/+, T/$t^n$ & $t^s/t^s$, and also sterile and quasisterile males of the genotypes $t^0t^s$, and $t^1t^s$ was made. In general, the spermatogenesis in the mice studied is similar to that studied and reported by other authors. Intensive search for abnormalities in squash preparations and sections of testes of quasisterile and sterile males of the genotypes $t^0t^s$ and $t^1t^s$ revealed that spermatogenesis was essentially similar to that of normals. A few differences noted are reported. The lack of synchronization of segregation of chromosomes to either pole is the main deviation from the work of Makino (1944) who claims that in the normal house mouse, the separation of chromosomes is synchronous. Examination of section sand squashes of testicular material, of fertile, quasisterile and completely sterile mice, shows that Makoni's ('44) statement cannot be applied universally. There is commonly seen in both controls and males with impaired fertility, a precocity of certain chromosomes in reaching the poles while most of the chromosomes are still in the Metaphase plate. Lagging of chromoxomes in Anaphase I was also noticed in all the genotypes studied. A statistical study of incidence of precocious segregation and lagging of chromosomes in both controls, quassi-sterile and sterile males reveals that there is no significant difference between the two. Since the pseudobridges, laggards and precociously segregating chromosomes are found in normal males also, and since these have been noted by Jaffe '51 in fertile males of other Genotypes ($Tt^1$ and Tt ) they are not related to quasisterility.

Reference to literature reveals that such non-synchronous segregation is a common feature in the Opposum, Horse, Rabbit, Rat, Japanese waltzing mouse and other strains of House mouse. The possible factors leading to this type of segregation are discussed in detail.

## 7. A study of the somatic chromosome complex in normal endometrium and in malignant tumour of the cervix uteri with an improved technique.

G. K. Manna *and* S. P. Ray Chaudhuri, Calcutta.

The epithelial tissue of (1) the endometrium in its proliferative stage from patients admitted in the Chittaranjan Seva Sadan, not suffering from any malignant disease of the uterus and (2) from patients in the Chittaranjan Cancer Hospital suffering from carcinoma of the cervix provided the material for the study of the somatic chromosome complexes of non-malignant and malignant cells respectively. Stickiness of the chromosomes in cancer cells is a serious obstacle to exact chromosome counts. This was avoided by a pretreatment of the tissue in saturated solution of Coumarin before making permanent slides either by the aceto-carmine method or by the Feulgen squash technique. Nearly sixty metaphase plates with well separated chromosomes in group (1) show that their numbers vary between 30 and 54, the most frequent numbers are between 40 and 50 which are very near the normal diploid set. Out of hundred and fifteen clear metaphase plates in group (2) the numbers vary between 26 and 134, but nearly 75% of the plates have numbers between 60 and 72 thus indicating a polyploid condition in the malignant tissue. The data, however, are to be further extended to reach any definite conclusion. The results are discussed in relation to the recent studies on normal and cancer chromosomes.

## 8. The histology and histochemistry of the thymus in *Calotes versicolor* (Daud).

M. Appaswamy Rao, Bangalore.

The conception of the thymus gland as an organ of internal secretion rests mainly on the evidences obtained by physiological experiments as there is no clear morphological evidence of any secretion by its cell components. Diverse opinions have been held in regard to the origin of the unicellular Hassall's corpuscles, multinucleated plasmodial masses and the granulocytes of the thymus.

In the thymus of *Calotes versicolor* the unicellular Hassal's corpuscles are found predominately in the medullary region. Their cytoplasm is acidophilic with concentric striations. All stages of transformation from an epithelial stromal cell to a large unicellular Hassall's corpuscle can be seen in the land. These corpuscles undergo progressive degeneration and eventually, cytolysis followed by resorption. The multinueleated plasmodial masses arise as fusion products of discrete epithelial stromal cells which eventually undergo liquifaction and resorption. In close relation with the unicellular Hassll's corpuscles and multinucleated plasmodial masses there are a few basophilic granulocytes with vesicular nuclei indicating their relationship with the epithelial stromal cells. These granulocytes have spherical golgi bodies in the cytoplasm, each having a central osmiophobic and peripheral osmiophilic areas indicating that they are secretory in function.

The alkaline phosphatase activity is predominant in the medullary region rather than in the cortex. The endothelium of the blood vessels and the thymocytes that are found near them shows a positive reaction. There is a gradual concentration of the alkaline phosphatase activity in the plasmodial masses as the process of degeneration increases. The high concentration of the alkaline phosphatase activity in the medullary region, where the vascularization is great, suggests that this enzyme plays an important role in the physiology of the thymus.

## 9. Physiological properties of living cells isolated from chick embryos.

Sivatosh Mookerjee, Calcutta.

The cells which form the chick gastrulae can be broken down experimentally by suitable alkaline pH exposures. The embryonic cells after dissociation exhibit certain physiological properties. Individual cells show a remarkable surface activity. Water molecules enter the cell with the result that the cell volume is increased. The surface layer happens to detach from a considerable area of the underlying granular cytoplasm in the form of hyaline bulge, which may rotate round the entire cell surface. Besides the surface activities, the inside cytoplasm with the nucleus performs a continuous churning movement. This movement is also significant in those cells which have not thrown out any bulge.

After long exposure, the cell wall becomes more permeable in the alkaline medium. Large intra cellular particles have been observed to escape through the cell membrane. Cells may often burst and disintregrete.

These changes in the cells may be stopped if they are put back into media of normal pH.

### 10. A quick method for paraffin sections.

V. B. Tembe, Bombay

Fixing, dehydration and paraffin impregnation are done under pressure, and it is found that the paraffin sections of a fresh tissue can be obtained within a period of 3 to 4 hours. The pressure gives better penetration of paraffin into the tissues and satisfactory soctims have been obtained.

## Genetics.

### 11. Curled Toes: A New Hereditary Defect in Poultry.

S. V. Chandiramani, S. S. Jawa, *and* P. Bhattacharya, Izatnagar.

While the normal toes of a fowl are straight a defect has been observed at the Indian Veternary Research Institute Poultry Farm, Izatnagar, in which one or more toes, in one or both feet, have lateral curling the expression of which has a continuous variation from mild to acute form. The fourth toe is not affected.

A cock and two hens exhibiting this defect showed poor egg production and hatchability. The few egg which were hatched, gave both defective and normal chicks, all of which however did not survive. Study of these and other available pedigrees and defective birds indicates a multiple gene action including lethal or sub-lethals.

## Marine & Fresh-Water Biology.

### 12. The Marine Plankton characteristics at an Inshore Station in the Gulf of Manaar near Mandapam.

R. Raghu Prasad, Mandapam Camp.

The paper is based on 154 samples of plankton collected from an inshore station, located approximately two miles off shore in the Gulf of Manaar near Mandapam, during January 1950 to December 1951. Fluctuations in the total plankton concentration, as indicated by changes in the standing crop, and gross qualitative and quantitative changes of the more important phyto- and zoo-planktonic elements have been described. The phytoplankton shows more than one peak during a year of which at least one seems to be a case of local flowering of a single species of diatom. The species concerned as *Rhizosolenia alata* in 1950 and *R. imbricata* in 1951. A bimodal cycle in the distribution of zooplankton has been observed. The copepods in this area show a distinct bimodal distribution as against the unimodal cycle reported from most other places along the coast of India.

The time of occurrence of maxima, the sequence in the succession and the abundance of different species have been noticed to be subject to variation from year to year. The study has further revealed an interesting fact that while the local plankton cycles have certain distinctive features of their own, they also show in some respects similarrities with those of the east and west coasts of India.

## 13. Observations on the seasonal variations in Phytoplankton production on the Indian Coast with special reference to the Waltair Coast.

P. N. GANAPATI *and* C. GOPINATHA RAO, Waltair.

There are two maxima of Phytoplankton intensity on the Waltair coast. The primary maximum corresponding to the spring bloom is from February to April with the peak in April. The secondary maximum corresponding to the autumn bloom is from October to December. The Phytoplankton intensity at Waltair, during the different months, compares with the conditions on the Madras coast where also there is primary maximum from March to May with the peak in May and a secondary maximum from November to January. The peak of the autumn bloom in both Waltair and Madras is in December. The primary maximum of Phytoplankton production at Krusadai in the Gulf of Mannar is from June to November. A secondary maximum has not been observed here. Comparing the seasonal variations of Phytoplankton in the above three stations on the east coast one observes a regular succession in the time of commencement of the primary maximum. At Waltair it begins in February, at Madras in March and at Krusadai in June. A similar phenomenon of succession of Phytoplankton production is observed on the west coast also. At Trivandrum the primary maximum is from January to May, at Calicut from May to September and at Bombay from September to February. Unlike the east coast the succession of Phytoplankton on the west coast is in a south to north direction. It therefore seems that the factor or factors responsible for Phytoplankton production move from north to south on the east coast and from south to north on the west coast. Surface currents on the east coast and rainfall on the west coast appear to be the major factors responsible for this succession of Phytoplankton intensity.

## 14. Observations on the planktological and hydrological conditions of the Korapuzha estuary, Malabar District.

P. C. GEORGE, Kozhikode.

This study relates to the planktological and hydrological conditions of the Korapuzha estuary (Malabar District, South India) during the period May 1950 to September 1952 based on weekly samples, to collect data on the seasonal and annual fluctuations and to determine the role of the river in replenishing the nutrient content of the inshore waters

The studies reveal that practically marine conditions exist during the period from January to May. A quick change to freshwater conditions has been noted subsequent to the starting of the monsoon lasting up to the end of August. The season from September to December reveals lower salinity with moderately high temperature. Plankton is rich from September to December coinciding with the active fishery season in the estuary. Large numbers of copepods, various stages in the development of *Alpheus, Palaemon, Hippolysmata* and *Lucifer* and *Acetes* and eggs of *Kowala* and larvae and post-larvae of *Ambassis* have been observed to form the major components. The phytoplankton fraction has been observed to be low throughout the year.

While the silicate and nitrate valves of the estuary have been observed to be uniformly high throughout the period of the monsoon months from June to August, the phosphate values were high only during the first few weeks after the commencement of the rains after which they were moderately low. From the present study it appears that the phosphate values of the coastal waters are not significantly influenced by the phosphates brought down by the river.

## 15. The seasonal variations and the succession of the fouling communities in the Madras Harbour.

A. Daniel, Madras,.

Although considerable work has been done on the fouling organisms, their seasonal variations, and their succession among them in European, American and Australian waters, very little has been done in tropical waters especially in the Indian Ocean.. Experiment were conducted for more than one year (from January 1950 to April 91951) at three different exposure sites, two of which were inside the Madras harbour and one outside, on the northeastern side of the harbour The different members of the animal community which settle and foul timber in the area studied are commented on. The most important of the animal community are the barnacles, *Balanus amphitrite variegatus*, *Balanus amphitrite communis* and *Balanus tintinnabulum tinninnabulum*. The number of the barnacles, the Polyzoan *Crisia* sp., and *Membranipora* sp., the Coelenterate *Laemedia spinulosa*, the compound ascidian, *Diandrocarpa brackenhielmi*, the tubiculous polycheate *Hydrodes norvegica* and the Mollusca *Modiolus straitulus* are recorded from time to time during the year the experiment was performed and the seasonal variation in different months noted. The advantage of a primary film of diatoms and algae for the settling of sedentary organisms is examined. The succession of different animals of the community settling on the experimental surfaces during the year is noted. The differences in the results obtained at stations located inside with those outside the harbour are discussed with reference to ecological conditions.

## 16. Bacteriology of Sea Water.

R. Venkataraman *and* A. Sreenivasan, Kozhikode.

Off-shore and inshore waters of Arabian Sea, off Telicherry were plated out on various media and the bacteria classified. Out of 32 strains from off-shore water, 15 were aerobic sporeforming rods, four *Sarcina*, two *Micrococci*, three *Flavobacteria*, two gram positive non-sporeforming rods belonging to Bacteriaceae (Kurthia) two *Ackromobacter* and four yellow, non-sporeforming gram ariable rods, which are pleomorphic and resemble *Streptobacillus moniliformis*. Six of the gram positive sporeformers were charmogenic, producing rosy growth on agar media. Twelve of these showed very wide range of salt tolerence, growing both on fresh water media and on media with 10% NaCl only 50% of the Cocci showed tolerence of 10% NaCl. Numerous colonies grow on distilled water agar and most of the colonies on Zobell's agar were rhizoid spreaders which proved to be *Bacillus spp.* occurrence of so many of these euryhaline *Bacillus spp.* is interesting from the point of view of preservation, since they would resist both heat and salt.

In the inshore water, out of 22 strains, 12 were cocci, (11 *micrococci* and 1 *sarcina*), two were spore forming *Bacillus spp.* one a lactose fermenting, non faecal coliform (*Aerobacter*), three were *flavobacteria* and four *achromobacter*.

The difference in the flora of these two samples of water may be due to the temperature and time of collection in which case there may be diurnal variations in the bacterial flora of sea water. Further studies on the salt tolerence of these organisms are under way.

### 17. Calcium content of some fish-waters of the Uttar Pradesh State.

M. P. Upadhyaya, Lucknow.

Calcium is one of the essential elements necessary for good growth of fish. The calcium ($CaCO_3$) content of 76 samples of pond waters collected from 27 tanks situated in eight districts was determined, and the values were found to range between a minimum of 1.4 to a maximum of 25.65 p.p. 100,000. The high values cover generally prevalent during summer months. 9.2% of the waters were 'poor' (values less than 2.5 p.p. 100,000 $CaCO_3$), 32.9% were 'good' (values between 2.5 and 6.25) and 57.9% were 'very good' (values above 6.25) when classified according to their calcium content. In a tank which showed fairly good growth of fish the calcium content varied between a minimum of 7.29 and a maximum of 25.65 p.p. 100,000 and the fish yield was 31 maunds, 12 seers and 12 chhataks in two years time. In a tank which showed poor growth, the calcium content ranged between 2.1 and 13.5 p.p. 100,000 and in one year the fish yield from this tank was only 8 maunds.

## Protozoology

### 18. Amacronucleate condition in *Epistylis articulata* (Fromentel).

B. R. Seshachar *and* C. M. S. Dass, Bangalore.

While examining the colonies of *Epistylis articulata*, the authors came across a number of individuals with only a micronucleus and no macronucleus. They were smaller than the normal vegetative individuals. They are formed as a consequence of an unequal division of the normal individuals. The macronucleus, during the division, fails to orientate at right angles to the axis of the body and remains dormant, while the micronucleus behaves normally. The subsequent behaviour of these amacronucleate individuals is interesting. They continue to live in this state for some period. The micronucleus, sooner or later, divided by mitosis. One of the products remains as a micronucleus, while the other enlarges and reorganises to form the macronucleus. The significance of this process of formation of a new macronucleus has been discussed.

### 19. The Nucleic acids of *Epistylis articulata* (Fromentel).

B. R. Seshachar *and* C. M. S. Dass, Bangalore.

The two main nucleic acids in the cell body are the Ribose-and Desoxyribose types. In recent years staining techniques have been evolved by which these can be specifically stained in the cells. One such is the Methyl green-pyronin mixture developed by Unna and Pappenheim. The purified Methyl green is chemically bound by polymerized DNA while Pyronin is bound by RNA in the cell. Using this technique and the Feulgen reaction, as also Toluidine blue and Haematoxylin one can assess the distribution of DNA & RNA in the cells. These various techniques were applied in case of *E. articulata* to study the nucleic acid cycle at various stages. The macronucleus is brilliantly Feulgen positive; the micronucleus is also, but very much less so. During the vegetative condition, in Feulgen preparations, the macronucleus shows a number Feulgen negative spaces. These spaces, in methyl green-pyronin preparations are stained with pyronin. They are stained deeply with toluidine blue and also haematoxylin. These facts seem to indicate that the spaces are pockets of RNA in the macronucleus. In extreme cases these pockets assume large proportions in the vegetative macronucleus.

The condition during conjugation is highly interesting. The macronucleus becomes fragmented. The fragments are highly Feulgen positive and are also stained brilliantly by methyl green indicating that they have large amounts of DNA. In later stages of conjugation and after the synkaryon has been formed, there appears in the centre of each fragment of the old macronucleus, a Feulgen negative space. This space is stained with pyronin in methyl green-pyronin preparations. In toluidine blue preparations it is deeply stained. This central space gradually increases in size and ultimately each fragment is seen as a mere ring in Feulgen preparations. At this stage the uptake of methyl green is very poor while that of pyronin is great Finally the entire fragment is stained by pyronin only. These stating reactions indicate that there is a gradual accumulation of RNA in the centre of the fragment which finally merges with the cytoplasm. The 'degeneration' and 'disintegration' of the macronucleus during conjugation would seem to be a conversion of DNA to RNA.

## 20. Nuclear apparatus of *Epistylis articulata* (Fromentel) during vegetative state, binary fission and conjugation.

C. M. S. Dass, Bangalore.

The nuclear apparatus of *Epistylis articulate* Fromentel is typical of members of the order Peritricha. The macronucleus is 'C' shaped and cylindrical while the micronucleus is spherical. The macronucleus is brilliantly Feulgen positive and has large quantities of DNA. The micronucleus gives a poor reaction with Feulgen and is faint. One of the interesting features of macronucleus is the presence of Feulgen negative spaces, which are often numerous and sometimes coalesce to form canaliculi. These spaces have been referred to as 'Nucleoli'

Two types of binary fission have been noticed in this species. In the first type, the macronucleus retains its vegetative form and orientates at right angles to the plane of division. As the cytosome constricts it is cut into two. The second is characterized by condensation of the macronucleus and a loss of its characteristic shape. It becomes polymorphic and sends out thread-like processes into the cytoplasm. It is later cut into two with the division of the cytosome. Each of the products becomes drawn out into characteristic from and shape.

In addition to the normal unimicronucleate individuals large numbers of bi- and trimicronucleate individuals have been observed. It is believed that this multimicronucleate condition arises from a possible tilt in the development and distribution of anlagen after conjugation.

Conjugation is characterized by the distinction between the two conjugants, respectively called micro- and macroconjugants. The micronucleus divides three times in the microconjugant but twice in the macroconjugant. Only one synkaryon is produced, for, by now the two conjugants have fused to form a synconjugant. The synkaryon divides thrice to give rise to eight bodies of which seven become macronuclear anlagen and the eighth the micronucleus. Later, reorganization fissions cause a distribution of the macronuclear anlagen in such a manner as to result in each daughter having a macronucleus and micronucleus. The behaviour of the macronucleus during conjugation is also full of interest. It is first drawn out into an elaborate skein which later breaks up into spherical fragments. These are brilliantly Feulgen positive but gradually each developes a Feulgen negative space within it. The fragments persist through the reorganization fissions but become fainter, and central Feulgen negative space also becomes larger with the result that towards end of reorganization each fragment is a faint ring. The number of fragments also gradually diminishes, during reorganization.

The condition found in *Epistylis articulata* has been compared with that in other Peritrichous forms.

### 21. The Gregarine Parasites from the gut of the Beetle *Opatroides* sp.

S. V. Dandekar *and* V. B. Tembe, Bombay.

This paper deals with *Gregarina opatroides* and *Stylocephalus opatroides* parasites found in the midgut of *Opatroides* sp., from the grain stores in Bombay. They are named as *G. opatrodies* and *S. opatroides* after the host in which they are found.

## Helminthology

### 22. An interesting new species of trematode from the gills of *Chorinemus lysan* (Forsk).

K. Ramalingam, Madras.

In the course of three years study of over 66 different forms of trematodes parasitic on Fishes of Madras, the author found a new species of trematode *Vallisia chorinemata*, on the gills of *Chorinemus lysan*. The external and internal features are described in detail and discussed with those of the only other known species of the genus. This is the first record of this genus from India.

### 23. A new genus of trematode parasites from the gills of *Sphyraena acutipinnis* Day.

K. Ramalingam, Madras.

The trematodes parasitic on South Indian fishes have never been studied before. One of these belonging to the family Microcotylidae and the sub family Gastrocotylinae, is described as belonging to a genus *Chauhanea* new to science. The presence of pre, para as well as post ovarial testes and asymmetrical haptor, are features of interest in this new species *Chauhanea madrasensis*.

### 24. A description of four new trematodes of the sub-family Haplorchinae (Looss, 1899) Poche, 1926 with a discussion of the systematics of the sub-family.

J. Dayal *and* S. P. Gupta, Lucknow.

A number of trematodes were collected from the intestine of *Silundia gangetica* (Ham.), *Rita rita* (Ham.) and *Macrones seenghala* (Skyes), at Lucknow and Gauhati (Assam) and they belong to the genus *Haplorchoides* Chen, 1949. The forms recovered belong to four new species.

I. *Haplorchoides gomtioensis* n.sp.

The works were found in the intestine of *Silundia gangetica* (Ham.) from the river Gomti at Lucknow. It differs from all the known species of the genus in the presence of a receptaculum seminis anterior to ovary, in the extentsion of vitelline glands up to the anterior region of receptaculum seminis and in the position of ovary which is between the receptaculum seminis and testis.

II. *Haplorchoides ritai* n.sp.

A large number of trematodies were collected from the intestine of *Rita rita* (Ham.), from the river Brahamputra at Gauhati (Assam). In its relationship the species stands nearest to *H. attenuatum*. It resembles the latter in the general topography of organs, but differs in the smaller size of the oesophagus, in the extension of intestinal caeca to the hinder half of the post-testicular region, in the extension of vitlline glands medially up to a little anterior to the hind end of the body and in having the anterior vesicula seminalis much lerger than the posterior.

III. *Haplorchoides brahamputraensis* n.sp.

Eight specimens were collected from the intestine of *Rita rita* (Ham.), from the river Brahamputra at Gauhati (Assam). The new form *H. brahamputraensis* n.sp., is closely related to *H. ritai* in the general shape of the body, in the position and the extent of intestinal caeca, in the shape and position of genital organs and in the shape of excretory bladder. It, however, differs from it and other related forms in having the genital pore outside the intentinal caeca and in having the receptaculum seminis smaller than the ovary and in the size of different organs.

IV. *Haplorchoides seenghali*, n.sp.

Twelve specimens of this form were collected from the intestine of *Macrones seenghala* (Skyes), from the river Brahamputra at Gauhati (Assam). The new form *H. seenghali* n.sp., in its relationship stands nearest to *H. ritai*. It resembles the latter species in the general topography or organs, extent and arrangement of vitellaria and in the shape of excretory bladder. It, differs from other related species in the size and extent of vesicula seminalis (except *H. attenuatum*) in the position and size of receptaculum seminis and in the position of genital pore on the left intestinal caecum. Further it differs from *H. attenuatum* in the distribution of vetelline glands.

The four new species are described along with a key to the species of the genus *Haplorchoides* Chen, 1949.

## 25. Two new trematode parasites of the family Opisthorchiidae Braun, 1901.

J. Dayal *and* S. P. Gupta, Lucknow.

I. *Thaparotrema vittalani* n.g., n.sp.

About 18 specimens of this form were collected from the gall bladder of *Rita rita* (Ham.), from the river Brahamputra at Gauhati (Assam). It closely resembles the genus *Opisthorchis* Blanchard, 1895, in the general topography of organs but differs from it and other known genera of the sub-family Opisthorchiinae in the extension of vitelline glands anterior to ventral sucker, and upto the hinder end of the anterior testis and in the shape of excretory bladder which is swollen at its anterior end.

II. ***Assamia gauhatiensis*** n.g., n.sp.

Only two specimens were collected from the intestine of *Rita rita* (Ham.), from the river Brahamputra at Gauhati (Assam). The new form differs from all the members of the family, except (*Gomtiotrema*), in the possession of a muscular oesophageal pouch from the dorsal side of which arise the two intestinal caeca, in the distribution of vitelline glands which are intercaecal in position and post ovarian, in having a long tubular excretory bladder with a vesicle-like structure at its anterior end from the side of which arise the two small lateral branches extending upto the anterior region of the ovary and in the position of genital pore which lies between the oesophageal pouch and the ventral sucker surrounded by strong sphincter muscles forming a common genital atrium. It closely resembles *Gomtiotrema*, in the possession of a muscular oesophageal pouch, in the structure and position of genital pore and in the possession of a long stem of excretory bladder. But, it differs from *Gomtiotrema* in the position of ventral sucker, in the position of genital organs which lie in the middle third of the body behind the ventral sucker and in the distribution of vitelline glands which are intercaecal in position.

In the paper a detailed description of two new genera is given.

## 26. A new trematode, *Brahamputrotrema punctati* n.g., n.sp., from a fresh-water fish, *Ophiocephalus punctatus* (Bloch).

J. Dayal *and* S. P. Gupta, Lucknow.

Four specimens were collected from the intestine of a fresh-water fish *Ophiocephalus punctatus* (Bloch), from the river Brahamputra at Gauhati (Assam). The new form differs from all the known genera of the family Monorchidae Odhner, 1911, in the distribution of vitelline glands which extend from the middle of the pharynx upto the middle of the ovary, in the absence of a muscular metraterm, in the presence of a unarmed protruded cirrus and in the possession of a tubular excretory bladder extending up to the hinder end of the ovary with side branches opening into it.

In the paper a detailed description of the form is given.

## 27. A new trematode, *Gauhatinae batrachii* n.g., n.sp., from the intestine of a fresh-water fish, *Clarias batrachus* (Linn.), of the sub-family Haplocladinae Odhner, 1911.

J. Dayal *and* S. P. Gupta, Lucknow.

Nine specimens of this form were collected from the intestine of a fresh-water fish *Clarias batrachus* (Linn.), from the river Brahamputra at Gauhati (Assam). The new form closely resembles the genus *Procteoces* of the sub-family Haplocladizne Odhner, 1911, in the position of genital organs and in the position of the circous sac on the side of the ventral sucker, but it differs from it in the structure of the excretory bladder which is Y-shaped and with a sigmoid median stem, in the position of excretory pore which is on the dorsal side at the posterior end, in the structure of the cirrus sac in which the vesicula seminalis and the pars-prostatica are tubular, in the possession of a musular genital sinus in front of the ventral sucker, in the possession of a large receptaculum seminis and in the distribution of vitelline glands.

In the paper a detailed description of the form and a discussion of the systematics of the family are given.

## 28. On a new trematode, *Oudhia horai* n.g., n.sp., of the sub-family Reniferinae Pratt, 1902 from the intestine of a fresh-water fish *Heteropneustes fossilis* (Bloch.).

J. DAYAL *and* S. P. GUPTA, Lucknow.

Only one specimen was collected from the intestine of a fresh-water fish *Heteropneustes fossilis* (Bloch.), from the ponds of Imphal (Manipur State). The new form is closely related to the genus *Neorenifer* of the sub-family Reniferinae Pratt, 1922, in the forward position of the genital pore located to one side in level with the prepharynx posterior to oral sucker but can be separated from it in the presence of a well developed receptaculum seminis, in having a well developed cirrus sac extending up to the hinder end of the ventral sucker, in having vesicula seminalis divided into two parts, in the presence of a ventral sucker smaller than oral sucker, in the distribution of vitelline glands, in having the funnel-shaped oral sucker and in the relative position of tests and ovary.

In the paper a detailed description of the form and a discussion of the systematics of the family are given.

## 29. *Semnopithecus entellus* (Himalayan Langoor) as the new difinitive host of *Dicrocoelium dendriticum* (Rudolphi, 1819).

P. A. HAWKINS, H. N. RAY *and* K. N. MEHRA, Mukteswar.

*Dicrocoelium dendriticum* from India was first recorded by Gaiger in 1910 from an ox in U.P. The distribution of this fluke in India, so far is known, is restricted to the hills of Northern India where it is commonly found in the livers of sheep and goats. The parasite has been recorded from a number of mammals throughout the world. Amongst the primates it has been recorded from *Papio sp.* (Baboon) *Cercocebus sp.* (Mangabey), *Cercopithecus sp.* (Guenon) and *Pan satyrus* (Chimpanzee). The cases of human dicrocoelism have also been recorded. The livers of three *Semnopithecus entellus* (Himalayan Langoor) out of 12 examined by the authors at Mukteswar were found to be infected with *D. dendriticum*. On one occasion the total number of parasites collected from the liver was approximately 474. The gall bladder was examined only once when it yielded only two worms.

## 30. Three new species of the genus *Otobothrium* (Cestoda) from Marine Fishes of Bombay.

F. S. KHAMBATA *and* D. V. BAL, Bombay.

In our studies on parasites of Marine fishes of Bombay, during the last seven years, we have recorded Cestodes, Nematodes, Trematodes, Acanthocephala, Copepodes, etc. The Elasmobranchs have been found heavily infected with Cestodes and hence this group has been studied to begin with. Upto now we have worked out about 70 species of Cestodes, belonging to 20 genera. Of these, 43 species and one genus appear new to science.

Under the genus *Otobothrium* Linton, 1890, we have recorded four species from different Elasmobranchs. Out of these, three are new to science and they are named as *Otobothrium vermicularies*, *O. septemspinigerens*, and *O. conglobatus*. These species are described in detail, with the necessary figures and sections, in this paper.

## 31. Two new species of the Genus *Discobothrium* (Cestoda) from the Marine Fishes of Bombay.

F. S. KHAMBATA *and* D. V. BAL, Bombay.

Under the genus *Discobothrium* van Beneden, 1870, two species have been obtained from *Trygon sephen*, *Rhychobatus djeddensis* and *Aetomylaeus maculatus*. Both these forms are new to science and are named as *Discobothrium quadrisurculi* and *D. redacta*. The present paper contains a brief description of both these species, with their diagnostic characters and evolutionary significance.

## 32. A subcutaneous tumour caused by Tapeworm larvae in *Columba livia* at Delhi.

L. N. JOHRI, Delhi.

A subcutaneous tumour was observed in the abdominal region of *Columba livia* at Delhi. A detailed study revealed the presence of a Coenurus in the tumour. The germinal layer is studded with multiple larvae. Cysts and the daughter cysts are of simple nature, and bear scoleces but no armature or rostellar hooks are present.

## 33. On the effect of Hetrazan in the removal of *Ascaris lumbricoides* from the digestive tracts of young children.

L. N. JOHRI, Delhi

With the recent increase of population, new townships have sprung up in Delhi State and its suburbs. *Ascaris lumbricoides* has been reported extensively from such areas. Insanitary methods and lack of personal hygiene are directly responsible for the pollution of the soil where eggs find favourable conditions and result in easy embryonation. Children show a heavy rate of infection. Most anthelmintics used for adults are unsafe to be administered to young children and infants. Hetrazan (1–diethyl –carbaml –4 methylpiperazine hydrochloride) has been clinically tested and found a very useful drug in such cases, although it is not showing optimum chemotherapeutic effects but its low toxicity has been of immense utility. The worms get paralized and are easily evacuated. These worms could live for 50–70 hours under ordinary laboratory conditions.

## 34. On a new Acanthocephalan, *Pallisentis nandai*, sp. nov., from the fish, *Nandus nandus* (Ham.),

H. L. SARKAR, Delhi.

Very little work has been done so far on Acanthocephalan worms, from the fresh water fishes of India. The material on which this paper is based, was collected from the intestine and liver of a small fresh water fish, *Nandus nandus* (Ham.). After making detailed study of the worms the author considers that it is a new species of the genus *Pallisentis* which at present includes three species, *P. umbellatus* Van Cleave, *P. gaboes* (Mac Callum) and *P. nagpurmasis* (Bhalerao).

The present species differs from the others in the following points:—(1) Sizes of males & females more or less similar but smaller than *P. nagpurensis*. (2) Number of spiny circles and the spines of the collar region, and of the body, differs from that observed in other species. (3) A distinct sexual dimorphism is observed with respect to the difference of circles of the body-spines in male and female. (4) The difference in length between the two lemniscii is distinct. (5) Distinct body nuclei are present. (6) The structure of the male genitalia is different from that of the rest.

## Crustacea.

### 35. The respiratory mechanism of *Balanus tintinnabulum* Linne.

A. Daniel, Madras.

Our knowledge of the respiratory mechanism of sessile barnacles is still incomplete and fragmentary. The present paper deals with the mechanism of respiration in *Balanus tintinnabulum*. The muscles responsible for the rhythmic upward and downward movements of the opercular valves as well as the opening and closing mechanism are described. The contraction of the lateral depressor muscle which takes half a second results in the separation of the opercular valves of one side from those of its pair at the occludent margin and opening the entrance to the mantle cavity, which is kept in this position for 2 seconds. By the co-ordinate contraction of the lateral, rostral and tergal depressor muscles which takes half a second the opercular valves are pulled downwards with the mantle entrance kept open and sea water is rejected out through the orifice. By the relaxation of all these three muscles the opercular valves revert to their previous positions. This takes a second and a half. From a a study of the graph showing the respiratory movements it is found that although the respiratory movements are regular and uniform when they take place yet they are frequently interrupted by periods of pause or spells of feeding movements of indefinite duration. Feeding results in setting up a feeble current while the movements of opercular valves induce a stray current.

## Entomology.

### 36. On the structure and function of a fold in the crop of the termite *Coptotermes heimi* Wasmann.

H. S. Vishnoi, Delhi.

While working on the alimentary system of the termite *Coptotermes heimi* the author discovered the presence of a prominent fold in the crop of both the worker and soldier individuals of this species. The fold is epithelial in nature and projects into the lumen of crop and may even extend into the proventriculus. A similar strucutre has been previously recorded in *Termes redemanni* Wasmann by Mukerji and Ray Chaudhuri (1943) who mention that this fold occurs only in the worker individuals and is absent in soldier and reproductive castes of the species. The reproductive castes of *Coptotermes heimi* however have not been available so far for similar investigations.

The fold in termites serves a very useful purpose in mastication of food. Firstly it presses the food particles into the crypts of proventricular teeth druring the working of the proventriculus; and secondly its bulging surfaces partly rub against the proventricular teeth and thus directly crush the food. The latter function is suggested on account of the thinness of intima which covers the regions of the fold just opposite to the proventricular teeth, and its remaining thick on the rest of the surface. Within the crop the fold possibly provides an additional absorptive surface for certain digested food materials chiefly the fats as already indicated by Abbott (1926) that in cockroach the crop is the chief region for absorption of fats.

The fold seems to have a fairly wide frequency in the crop of termites and the author suggests that this fold may be termed as *ingluvial fold*.

## 37. Feeding habits and the physiology of the alimentary canal of certain Leafhoppers (Jassidae : Homoptera).

K. N. Saxena, Delhi.

Species of Jassids were found to show a certain specificity to plant-tissues from which they suck their food sap. On this basis two categories of these leafhoppers can be recognised: one includes the species of *Empoasca* and *Empoascanara* which suck the sap from the mesophyll tissue of the leaf, and the other includes those forms which primarily feed on the vascular tissue.

The physiological significance of this specificity of jassids to a particular plant-tissue is partly elucidated by the results of investigations on the physiology of their digestion. The digestive tract of the mesophyll-feeding jassids secretes the enzymes: trypsin, erepsin, diastase, maltase, invertase, lipase and, in some species, chlorophyllase. These enzymes hydrolyse proteins, proteoses, starch, maltose, sucrose, fat, and chlorophyll, contained in the mesophyll cells, into the diffusible substances which can be utilised by the insects. The jassids that feed on the vascular tissue, however, lack the enzymes trypsin, diastase, lipase and chlorophyllase; the only enzymes present in them being maltase, invertase and erepsin. They, are, therefore, incapable of utilising the nondiffusible substances like proteins, starch, fat and chloroplasts contained in the mesophyll cells. Only soluble sugars and proteoses can be utilised by these jassids

This suggests that the specificity of jassids to a particular plant-tissue is related to the distribution of digestive enzymes in their alimentary tracts.

## 38. Organs of Digestion and Excretion in the Jassidae (Homoptera).

K. N. Saxena, Delhi.

The morphology of the digestive and excretory organs was studied in thirtyfive species of Jassids belonging to eleven different sub-families and tribes.

The digestive system consists of a set of salivary glands, a short pharynx, a narrow oesophagus, a long, wide and coiled midgut, a short and narrow intestine and a pear shaped short rectum.

The salivary glands lie on either side of the oesophagus and consist of a pair of principal glands and pair of accessory glands which open into the latter by short ducts A salivary duct leads from each principal glands to the salivary syringe. The modifications of these glands are discussed in the paper.

The alimentary canal and the malpighian tubules together present three conditions in the family Jassidae: (i) In the Typhlocybinae, the two end portions of the U-shaped midgut lie apposed to each other but are not enclosed within any chamber by a common sheath; the wall of the midgut includes a layer of longitudinal muscle fibres. The four malpighian tubules open into the posterior end of the midgut and are united together at their distal ends with their lumen becoming confluent.

(ii) In the Balcluthini, the two apposed extremities of the midgut are enclosed within a chamber, the "filter chamber", by a thin sheath of connective tissue; the midgut wall is devoid of longitudinal muscle fibres. The malpighian tubules open into the distal end of the midgut within the filter chamber; their distal ends are united together, as in the Typhlocybinae

(iii) In the rest of the jassids, the "filter chamber" is quite large, incorporating a long and more or less coiled portion of the ascending limb of the midgut; the latter is devoid of longitudinal muscle fibres. The malpighian tubules do not join together at the distal ends but they reassociate separately with the rectum.

On the basis of these characters the systematic status of the Typhlocybinae and the Balcluthini is discussed in the paper.

## 39. The musculature and its postembryonic development in certain Jassids (Homoptera).

K. N. SAXENA, Delhi.

The musculature of a dozen species of the family Jassidae, representing six sub-families, has been described in detail. The postembryonic development of the musculature has been studied in two genera, *Phrynomorphus* and *Empoasca*, and it is more or less similar in both.

The musculature of the head and abdomen does not undergo any change during the metamorphosis except a proportionate increase in the size. As regards the thoracic musculature, it is almost similar in all the three segments in the first three nymphal instars. The only muscles present are: the ventral, the pleurosternal, the extracoxal extensor of the trochanter, the coxal remotors and the coxal promotors; the latter arising on the tergum. In the fourth nymphal instar the origin of the meso- and metathoracic coxal promotors shifts to the corresponding pleuron; the dorsal longitudinal and the oblique muscles also appear in these two segments. In the fifth instar the area of the origin of the metathoracic extracoxal extensor of the trochanter extends to the second phragma. The rest of the muscles appear after the last moult.

As regards the development of the musculature of the male genitalia, in the first two nymphal instars the muscles of the genital segments are similar to those of the anterior abdominal segments. In third instar a pair of tergoparameral muscles appear. In the fourth instar there develop the tergoplatal muscles while the dorsoventral muscles now become the tergo-subgenital muscles. In the fifth nymphal instar the interparameral and the platoparameral muscles make their appearance. The remaining muscles of the adult genitalia appear only after the final moult

## 40. Physiology of the alimentary canal of *Pyrilla perpusilla* Walk. (Fulgoridae : Homoptera).

S. P. BANERJEE, Delhi.

This paper deals with the enzymes present in different parts of the digestive tract of *Pyrilla perpusilla*. The salivary glands secrete only one enzyme, the diastase. The mid-gut secretes diastase, maltase and invertase, and no enzymes are present in the crop and in the hind-gut. Lipase, chlorophyllase and proteolytic enzymes, like trypsin and erepsin are entirely wanting.

Extra oral digestion of starch by the ejection of diastase during the act of feeding has also been determined.

## 41. Studies on Pea Aphid (*Macrosiphum pisi,*) Control.

H. L. KULKARNY, Anand.

(1) Winter peas are an important commercial crop in and round about Poona, in Bombay Deccan. However, control of pea aphid is a serious limiting factor in the successful cultivation of this crop.

(2) Environmental factors such as temperatures and humidities influenced aphid population in the field. Mean temperatures ranging between 64.2° to 69.6° F. and the atmospheric humidities varying between 60% to 70% were very congenial for aphid multiplication.

(3) It was observed that if early sprayings with nicotine compounds were taken up when yet the apterous forms had not spread to lower portions of the plant, it was possible to control the aphides effectively.

(4) Relatively low temperatures at the time of applications of nicotine compounds gave varying kill percentages of the pest.

(5) Wettable D.D.T. sprays at a concentration of 0.2% did not give adequate control of the pest.

## 42. Life history studies of Aphids.

H. L. KULKARNY, Anand.

(1) The life history studies on different aphides revealed that the interval between two successive instars was slightly irregular.

(2) Aphids generally moulted four times during their nymphal stage and their life cycle period varied from 6.6 to 8.0 days.

(3) Temperatures between 70.5° to 83.9°F. are found congenial for aphid breeding in the laboratory.

(4) *Rhopalosiphum pseudobrassicae* on cabbage reproduced maximum in the third generation. *Macrosiphum jaceae*, during the same period comparatively reproduced less. However, from the field observations it was noted that the threshold of development for the latter aphid was some time in the third week of January when the mean temperatures were from 60.0°–64.2°F.

## 43. Systematic study of *Pyrilla* spp. (Fulgoridae : *Lophopinae*) infesting sugarcane in India with notes on the morphological structure of the chitin in relation to the insecticidal action on it.

S. MUKERHJI *and* V. G. PRASAD, New Delhi.

Only one species of *Pyrilla* viz. *Pyrilla perpusilla* Walk is in existance the others being mere colour varieties of the same. The exact position of the different colour varieties has been fully discussed. The structure of the genitalia of male and female has been studied in detail and the various parts are homologized. In the female the structure of *bursa copulatrix* and *spermatheca* has been described for the first time in the Indian *Pyrilla*. The cross-breeding experiments on the first three varieties were found to be successful. A new form of *Pyrilla* viz. *Pyrilla perpusilla* var *nigriventries* nov has been collected from the vicinity of Delhi as described in detail. This form failed to inter-bread with other known varieties. It has been found that there are seasonal variations or 'phases' in *Pyrilla* indicating the concomitant colour variations in the different forms found during the year. It has more than likely that not only the quality of the food but the quantity of food available per individual basis also is responsible for this change of colour-phases of *Pyrilla*. A graphic representation showing the relationship of temperature and humidity with the local field population of *Pyrilla perpusilla* Walk, with their varieties covering an entire season has been incorporated. The water-content of *Pyrilla perpusilla* Walk has been determined. It varies between 59.9 to 71.8% with an average of 66.0%. The first tarsal joint of the hind leg has been found to be the most susceptible and vulnerable region as compared to other parts of the body for the positive action of certain insecticides. An attempt has also been made to correlate the detailed anatomy of the first tarsal joint with its vulnerability. Out of all the insecticides used 'Gammexane' P 520 water dispersable powder 2.0% B.H.C. and nicotine sulphate 0.15% respectively were found to be the most effective against *Pyrilla*.

## 44. Bug predators of insects damaging stored grain.

S. V. PINGALE, Mysore.

Three species of bugs predacious on insects damaging stored grain have been observed in the grain warehouses of Bombay and Mysore States. These are *Peregrinator biannulipes* Mont., *Amphibolus venator* Klug. and *Triphleps* sp. The first is found to feed on the adults of *Rhizopertha dominica* F., *Trogoderma granaria* E., *Tribolium castaneum* H. and *Corcyra cephalonica* St. and the third on the eggs and larvae of *C. oryzae*., *Laemophloeus ferrugineo* St. and *Oryzaephillus surinamensis* O. From their feeding habits the predators appear to be promising in effecting a control of the insects on which they feed. Due to the use of residual insecticides in the warehouses and the susceptibility of the predators to it, large scale observations to confirm their efficiency have not been possible

## 45. A Cockchafer beetle-new pest of cocoanut palms.

K. K. Nirula, J. Antony *and* K. P. V. Menon, Kayangulum.

The larvae of a cockchafer beetle *Lepidiota* sp., (Family Melolonthidae) were observed as serious pest on the roots of cocoanut palms, for the first time in India, in certain parts of Quilon district (South India), during 1951. The young larvae feed on the tender roots and root hairs, and grown up ones nibble the established roots of the palms and sever them from the bole. The leaves of the attacked palms turn yellow, immature nuts fall off from the stalks, and rate of production of spathes is very much retarded. Maximum damage is observed during March, April and May, when the coconut palms in the affected areas appear quite barren. Root crops like tapioca, sweet potatoes, yam, colocassia, etc., are also badly damaged by these grubs.

The adult beetles emerge from the soil 'En masse' after a fortnight of the commencement of South West Monsoon in June and July. Stray speciemens continue to emerge from the soil sometime before and after this period. The beetles are active for about an hour after sunset and for some time in the early hours of the morning Mating takes place during these hours of activity. Eggs are laid singly in the humid soil at a depth of 3 to 6 inches. Incubation period is about three weeks. Larvae are white, with brown heads and fleshy bodies, and can be distinguished by the presence of rusty abdominal hump, and two longitudinal rows of short spinules on the ventral surface of last abdominal segment. Larval period is about 10 months. Pupae resemble the typical fleshy Scarabaeid pupae. The beetles rest for some period in their cells, before emerging out of the soil.

## 46. The head musculature of the Firefly *Luciola gorhami* Ritz. (Lampyridae-Coleoptera).

P. N. SAXENA, Patna.

The musculature of the mouth parts of *Luciola gorhami* Ritz is described. Labrum is not at all provided with muscles and is directly attached. The mandibles are simple conical structures articulated to the pleurostomal margin of the cranium. The mandibles of the carnivorous beetles so far described are provided with teeth-like structures but in this lampyrid beetle, a marked simplicity is observed, and they are operated by very powerful adductor and adductor muscles. The muscle arrangement of the maxilla has become exteremely simple due to complete fusion of cardo and stipes and also the galea and lacinia. It is interesting to note that labium has only one set of muscles–the levators, the depressors are absent. The difference between the male and female antennae is very characteristic and they possess such short and thick muscles that their movement becomes very restricted. Lastly a comparision with the head musculature of other beetles of allied families has been made.

## 47. Observations on the life-history of *Lema signatipennis* Jac., (Chrysomelidae) as a pest of turmeric (*Curcuma longa*).

G. C. Sengupta *and* B. K. Behura, Cuttack.

*Lema signatipennis* Jac., is recorded for the first time as a pest of turmeric in India. The life-history from egg to adult takes about 40 to 50 days. The different stages i.e., egg, larva, pupa etc., are described. *L. signatipennis* also feeds on Cucurbita, brinjal (*Solanum melongena*) and Sorghum (*Andropogon sorghum*). The pest is confined to the district of Phulbani in Orissa.

## 48. Bionomics of the *Alphitobius diaperinus*-A pest in the grain stores.

Miss K. A. Vaidya *and* V. B. Tembe, Bombay.

*A. diaperinus* is cosmopolitan is distribution. It is a dark brown beetle living on almost any kind of food material, especially broken grains. Like a typical holometabolous insect its life cycle consists of egg, larva, pupa and adult stage. In the first part of this paper these stages are described in brief.

The second part of the paper consists of experiments set in to conclude the optimum temperature and humidity required by these beetles to grow. It is found that the optimum temperature is 33°c. and himidity 95%, for the favourable growth of the beetles.

## 49. The poison apparatus of a Braconid wasp.

S. Mashhood Alam, Aligarh.

The poison apparatus of *Stenobracon deesae* stands as a novel feature for Braconidae, being different in structure from what has been so far described by Snodgrass (1925) James (1926) and Bucher (1948) in Hymenoptera. Innumerable tubular acid glands open at the base of reservoir and are distinctly glandular in nature. The alkaline gland has no independent nature as is the general feature of Hymenoptera. It is, exactly speaking, the poison duct whose epithelium is modified into secretory structure. Bender (1943) in *Habrocracon juglandris* gives a different account. The reservoir is oval and highly muscular with ctenidia-like intimal lining. The present writer records the presence of reservoir's epithelium which Bender (1943) reports as absent.

The external female genitalia forms the distal portion of the apparatus. It is of typical hymenopterous type with three pairs of long valvulae. Details on its structure and working have been read at the Calcutta Session (1952). In the present paper it is referred as a puncturing organ, as well as a passage for the flow of poison from the reservoir to the wound in the host's body.

The reservoir has the double function of suction and ejection of poison like the salivary syringe of hemipterous insects. These functions are discharged alternately at the time of stinging.

## 50. Seasonal incidence of Hymenopterous insects parasitising egg masses of *Tabanus* flies.

B. C. BASU, P. BALARAMA MENON *and* C. M. SEN GUPTA, Izatnagar.

During the course of investigations on the bionomics of *Tabanus* flies at five different areas around Izatnagar, it was noticed that egg laying was prevalent during spring, monsoon and post:monsoon months. In one area out of the five namely, Kareli Kargana, the egg masses were found parasitised by hymenopterous insects. The observation was continued for one year and the incidence of these parasites was recorded only in the months of March, April, May and October. During these months most of the egg batches in the area were found affected and in the infected batch almost all the eggs were found parasitised. No special perference for a particular species of *Tabanus* was noticed. The egg masses of two of the common species in the area *Tabanus rubidus* Wied. and *Tabanus macer* Bigot were found equally parasitised. It has been easy to breed these parasites into adults in the laboratory when the infected egg batches were kept in a moist chamber. The stuydy on its life history, taxonomy and its utilisation in the biological control of *Tabanus* flies is in progress.

## 51. Seasonal emergence of Mango leaf Gall Insects in Gujarat (Bombay).

H. L. KULKARNY *and* R. C. PATEL, Anand.

Wasps of the genus *Platygaster* and Cecidomyiid flies-*Allasomyia tenuispatha* (Kieff.) were observed to cause blister galls on the leaves of mango.

(1) Atmospheric humidities and temperatures mainly influenced 'the emergence of gall insects. Sharp rises and falls in the temps. and humidities during the pre-monsoon month marked the emergence of the pest. Low temperatures varying between 84.4° to 89.3° F. accompanied by comparatively high humidities varying between 70% to 85.5% favoured the emergence of adults.

(2) No significant difference was noticed in the emergence of wasps and gall flies. Both the insects behaved similarly with regard to emergence.

(3) The emergence of the gall insects invariably coincided with the new growth on the host

(4) Pre-adult period of the insects was spent within the galls and this period ranged between 180 to 200 days between March and July.

## 52. The importance of *Sphaerophoria scutellaris* (Fabr.) as a predator and its longevity and fecundity.

RATTAN LAL *and* E. HAQUE, New Delhi.

The longevity and fecunduty of *Sphaerophoria scutellaris* (Fabr.) have been studied. The number of aphids consumed per maggot during the entire period of its development depends much on the temperature and humidity. The aphids consumed per maggot at 19.8°C. vary from 401 to 439 and at 22.2°C. from 308 to 339. At 19.8°C. the maggot completes its development within 12 to 13 days and at 22.2°C, within 8 to 9 days. With the rise or fall of temperature there is always a gradual decrease in the consumption of the aphids

The experiments conducted at different temperatures (20°C, 25°C and 30°C) and at different relative humidities (50, 70 and 90 per-cent) show that the sugars, i.e., glucese, fructose, sucrose, maltose and mannitol are significantly better than other type of food in increasing the longevity of the adult.

Temperature and relative humidity also play an important part in modifying the longevity and fecundity of the adults. The temperature of 20°C, significantly prolongs the life of adult as compared to 25°C and 30°C irrespective of food and humidities. The insects live longer at 25°C than at 30°C.

The low humidity at high temperature is detrimental to the adult and thereby adversely affects both the longevity and fecundity, whereas high humidity is useful. The insect lives for a longer time at 20°C with 70 per cent relative humidity, as compared with 90 or 50 per cent relative humidity at the same temperature. The longevity of the insect at 25°C with 90 per cent relative humidyty is more as compared with 70 or 50 per cent relative humiduty. A relative humidity of 90 per cent increases the longevity of the insect kept at 30°C as compared to 70 per cent 50 per cent relative humidities

Apart from the question of food, temperature and humidity, it has been observed that the mated adults live longer as compared to the unmated ones. Thus it can be concluded that for the artificial breeding of this insect, sucrose is the best food and 20°C with 70 per cent relative humidity is the best temperature humidity complex.

## 53. Experimental studies in insect parasitism—superparasitism in *Trichogramma evanescens minutum* Riley.

E. S. NARAYANAN *and* P. B. MOOKHERJEE, New Delhi.

Though superparasitism is a normal and regular occurrence in insect parasitism there have been few contributions based on experimental evidence to prove beyond controversy whether this phase in insect parasitism is due to an error of instinct or due to scarcity of hosts. Salt (1934) hes dealt the subject in detail while working with the parasite *Trichogramma evanescens minutum* Riley and, its host *Sitotroga cerealella* Oliv. and has shown that the parasite is able to distinguish between parasitised and unparasitised hosts and that superparasitism only occurs when the hosts are very much limited and when the restraint of the parasite from oviposition fails in the presence of a fewer or unsuitable hosts.

Our present studies show that in this parasite the instinct to oviposit soon after emergence and almost immediate mating is so great that it does not even leave off a host egg quickly and attacks and oviposits on the same egg twice or thrice from different angles although it might have fresh unparasitised host eggs by its side and all around it. The urge for egg laying is so great that this parasite sometimes lays two eggs in a host during single insertion of the ovipositor. This explains as to why (a) this parasite sometimes fails completely to parasitise its host even if the host number is limited in relation to the egg laying capacity of the parasite and this is not simply by mistake as Salt (1937) observed, (b) superparasitism occurs both at high and low density of host egg population. If we accept the theory of discrimination and restraint enunciated by Salt (1937), there should be no superparasitism when the density of the host population is high. The same explanation holds good also when a female parasite oviposits in an egg already parasitised by another, especially when fresh unevoviposits in an egg already parasitised by another, especially when fresh unparasitised host eggs are available by the side of the parasitised ones. The discrimination is, perhaps, there but that is sometimes over ruled by its eagerness to oviposit and for which superparasitism occurs.

Our observations further show that this parasite is unable to distinguish between a healthy and damaged egg, for instance an egg pricked by a neelde, for oviposition but leaves off a damaged egg that has been completely crushed and dried up. Neither can this parasite distinguish between a fertilized and unfertilized host egg for oviposition. These observations, therefore, clearly indicate that superparasitism is not in any way dependent on the nature of host eggs.

The present investigations have also shown that superparasitism progressively decreases with increase in host density for a single female but it is never absent. Superparasitism seems to be governed more by the number of host eggs available rather than the period of exposure.

## 54. Effect of rainfall on the toxicity of DDT & BHC.

K. K. Nirula, J. Antony *and* K. P. V. Menon, Kayangulum.

The use of DDT spray has been suggested for the control of *Nephantis serinopa* Meyr., a serious pest of coconut palms in India. In some preliminary trials for the control of the same pest, BHC was also found to be efficent. Besides other environmental factors rainfall plays a great part in reducing the toxicity of insecticides. During 1951 and 1952, a series of experiments were started to determine the effect of rainfall, under natural conditions, in so far as possible, on the rate of loss of insecticidal residues of DDT and BHC sprayed on the leaves of the coconut palm, by biological assay.

From the data collected, it was found that 0.2% DDT spray retained 40% toxicity, after two months of heavy rainfall, during which period more than 18 inches of rain was recorded. 0.2% BHC spray lost all its toxicity after 5.2 inches of rainfall in ten days. Other factors like humidity, temperature, winds, sunshine, etc., also affected the toxicity of the chlorinated hydrocarbons used in these trials.

## 55. Value of a few proprietary preparations in the control of ectoparasites of livestock.

P. Balarama Menon, C. M. Sen Gupta *and* B. C. Basu, Iztnagar.

In order to evaluate the insecticidal action possessed by them, nine proprietary insecticides viz., Kitkari AP/5045, Kitkari AP/1035, Kitkari BP/505, Hexamar, Benexide WP 50, Lorexane dusting powder, Sarcoptan, Lethane B 71 and Rhothane D 3 were tested in varying dilutions on different species of arthropods infesting live stock.

Kitkari AP/5045 (diluted 1.2 ounces to a gallon of water) was found very effective against goat lice both biting and sucking, *Bovicola caprae* Gurlt and *Linognathus* Endl. and buffalo lice *Haematopinus tuberculatus* Giebel. Against ticks, *Hyalomma aegyptium* Linn. and *Rhipicephalus sanguineus* Latr. only partial success was obtained as it did not completely eradicate the ticks. Kitkari AP/1035, Kitkari BP/505, Hexamar, Rhothane D 3 and Lethane B 71 (1 in 6) when dusted into the feathers of birds rid poultry of poultry lice, *Menopon* L. sp. and *Goniocotes* Nit. sp. Hexamar and Benexide WP 50 (0.5%) controlled lice infestation in goats, cow and buffalo calves

(*Bovicola caprae, Linognathus* spp. and *Haematopinus tuberculatus*) and completely eradicated the infection within 24 hours. Benexide WP 50 (0.5%) also controlled effectively tick infestation in dogs, *Rhipicephalus sanguineus*, but reinfestation took place after 7 days. Lorexane dusting powder was found satisfactory in the control of live infestation in cow calves and goats. Single dusting eradicated *Bovicola caprae* but not *Linognathus* sp. Sarcoptan (1 in 100) applied on dogs infested with demodectic mange cured the dog of mange (*Demodex canis* Leydig). A second application after a week was necessary to bring about complete cure. No reinfestation was noticed for a period of six months.

## Arachnida.

### 56. A note on the development of *Buthus tamulus* (Fabr.) (Scorpion).

V. B. TEMBE, Bombay.

The paper deals with the early development of *Buthus tamulus* (Fabr.). It is found that the so-called large nucleus of the egg is not the true nucleus, but a yolk nucleus from which small globules are given out to form large yolk spheres in the embrayo. The true nucleus is adjacent to the yolk nucleus. The cleavage takes place at this region only, and not at the periphery as is believed. The daughter nuclei first appear in the centre and then migrate towards the periphery of the ovum to form the blastoderm. This type of development is more similar to that of other Arthropod groups. The blastodern cells on the ventral side become enlarged to form the germ disc.

### 57. A note on Spiders of Bombay region.

M. K. THAKUR *and* V. B. TEMBE, Bombay.

A brief account is given of the common spiders found in human habitations of Bombay. Eight families are represented by several species which are briefly described.

## Mollusca.

### 58. A note on the food value of the edible portion of the Indian Chank (*Turbinella pyrum*).

R. VENKATARAMAN *and* S. T. CHARI, Kozhikode.

The edible portion of the Indian Chank fished off the southern districts of the Madras Presidency on the East Coast has been evaluated for their proximate composition viz; Moisture, Protein, Fat, and total mineral matter. Phosphorus, calcium, iron, copper and salt content have also been evaluated. The fisherman community use the edible portions of the Chank as a fried delicacy in the form of Chank flesh chips, the preparation of which has been described. The food values of this are also reported. The food values of the Chank flesh in the raw state compare favourably with the Chank flesh chips and it is concluded that the chank is a good source of proteins and minerals.

### 59. Existence of physiologically different races of *Modiolus striatulus*.

R. NARAYANASWAMY, Madras.

The existence of physiologically different races of the same species of bivalves has been noted by many. *Modiolus striatulus* occurs both in the brackish water areas and in the sea and evidences for the suggestion that these may belong to physiologically different races are presented in this paper, based on experiments conducted on the toleration of these mussels to salinity changes. It is found that the optimum salinity for harbour forms is between 27.82% and 33.12% whereas for the brackish water forms it is between 19.84% to 27.82%. The mussels from the brackish water areas tolerate wide ranges of salinity (from 8.4% to 33.12%), whereas the marine forms are able to tolerate only small variations (20.81%–39.02%).

## 60. Probable path of sperm transference in *Cerithidae cingulatus*, Gmelin (Gastropoda-Pectinibranchia) as indicated by the ciliary currents in the mantle cavity and gonadial ducts.

V. SADASIVAN, Port Blair.

From a study of the sections of the mantle cavity and the ciliary currents on the floor of the mantle cavity and in the passage of the genital duct an attempt has been made to infer the probable mode of sperm transference in the common backwater Gastropod of Madras, *Cerithidae cingulatus*. In the absence of a male accessory organ sperms have to enter the mantle cavity with the incoming current through the inhalant aperture. It is probable that they are taken along the floor of the cavity by the ciliary currents but to pass over the ciliated food groove where they meet a strong oppositing current they are aided by their powerful cork-screw like swimming movements and reach the seminal pouch or the oviduct which are only open grooves on the mantle roof. Ciliary action at the base and on the lateral walls of the grooves takes them over the folds into the grooves. Sperms are stored in the seminal pouch. Exact stimulus applied for the passage of the sperm is not known. Absence of the male accessory organ, ciliary currents in the mantle cavity and the open condition of the oviduct are characters closely associated with the habitats of the animals.

## 61. The histology and histochemistry of the genital tract of *Ariophanta maderaspatana* (Gray).

V. K. SUNDARARAJA IYENGAR, Bangalore.

Recent findings emphasize the role and importance of enzyme systems in living cells and a biochemical approach to all biological problems seems very necessary, and almost inevitable. Histochemical approaches from this angle to determine the distribution and localization of the important enzyme alkaline phosphatase in the genital tract of pulmonate mollusc *Ariophanta maderaspatana* revealed, that the enzyme is distributed in the form of fine granules (a) on the tail region of the sperms (found in the hermaphrodite gland) and also (b) in the cytoplasm of the growing oocytes. The nurse cells, as well as the nucleoli of the oocytes also show a strong positive reaction. In addition the coloumnar ciliated cells lining the lumen of the hermaphrodite duct, the inner epithelial lining of the oviduct, the calcium crystals found filling the lumen of the kalc sac, the epithelial lining of the flagellum and the highly coloumnar, ciliated and folded part of the epithelial lining of the capsular gland, give a strong alkaline phosphatase positive reaction, thereby suggesting the presence of the enzyme in great concentrations in these regions. The rest of the parts, however, like the nonciliated part of the lining epithelium of the hermaphrodite duct, the nonciliated non-folded part of the epithelial lining of the capsular gland the different layers making up the vas deferens and sperms filling the lumen of hermaphrodite duct give a negative reaction for the enzyme, thereby suggesting either a complete absence of the enzyme in those regions, or its presence in very negligible quantities. Further work in this direction is in progress and it is planned to study the distribution of this enzyme under various experimental conditions

## Vertebrate Morphology & Embryology.

### 62. On the development of the vertebral column of the labyrinthodon fish, *Anabas testudineus* (Bloch).

H. K. MOOKERJEE, D. N. GANGULY *and* S. C. GANGULY, Calcutta.

The present work is the continuation of the series of studies on the vertebral column of vertebrates and was undertaken to find out whether the basic principle as shown by Mookerjee and others are followed even in a labyrinthodon fish like *Anabas testudineous* or not. Following results are obtained:–

(1) The notochord is vacuolated in the intervertebrals and vertebrals except interavertebral (mid of the vertebral) portion where it is solid and non-vacuolated. The solid notochord directly ossifies without passing through the stage of chondrification and becomes homogeneous with the perichordal tube in the adult condition.

(2) There are usual two sheaths of the notochord in the region where it is vacuolated. The non-vacuolated region possesses only single outer sheath.

(3) The centrum is primarily formed by the inner and outer perichordal tubes together with notochordal sheaths remaining outside the notochord and completely enclosing it. Finally the primary centrum undergoes partial degeneration and the secondary adult centrum is formed by the ossification of skeletogenous cells deposited round the primary centrum as the plastering substance.

(4) The neural and haemal arches are primarily developed as mesenchymatous deposition around the spinal chord and aorta respectively but they also undergo degeneration and outside of this degenerated arch element skeletagenous layer deposited as plastering substance form the main arch elements.

(5) All the precaudal vertebrae possess two ribs on either side. First and second vertebrae possess dorsal and pleural ribs, while the others have two pleurals, one upper and the other lower, on each side. The upper rib is cartilaginous and remains surrounded by a jacket of connective tissue which afterwards ossifies to form a bony tube. The lower rib develops as fibrous strand and afterwards ossifies to form membrane bone element.

(6) All the ribs primarily attached to the rib-bearing process are developed in connection with the arches. But as these processes also undergo degeneration the plastering substance form some sort of cup-shaped articulating area around the degenerated mass.

(7) The skull is articulated with the vertebral column by various ways. The heavy zygapophyses formed in the occipital vertebra and first vertebra are the main articulating areas.

(8) The spinal ganglia remain very small in the early condition but along with the growth of the fish they become heavy and much descended due to their bulk and weight. The size of the ganglia of the adult fish is unusual and massive.

### 63. On the development of the olfactory capsules in the chondrocranium of *Ophiocephalus punctatus* (Bloch).

H. SWARUP, Sagar.

The early development of the olfactory capsules in *Ophiocephalus punctatus* has been described

The trabeculae in the ethmoidal region first appear in embryos 3.8 mm. in length. By 5.2 mm. stage the anterior ends of the trabeculae fuse to form the ethmoidal plate.

The internasal septum arises as a median ridge on the dorsal side of the ethmoidal plate at this stage but becomes more prominent in later stages. At 6.3 mm. stage the lamina-orbito-nasalis arise from the sides of the ethmoidal plate and by 7.5 mm. stage this fuses with the sphenethmoid commissure of the orbital cartilage. The internasal septum also fuses with the sphenoseptal commissure of the orbital cartilage. Thus the nasal capsules are formed.

The nasal capsules are incomplete as the posterior boundary and the roofing bars formed by the lamina orbitonasalis as found in some fishes like *Amia* and *Lepidosteus* are completely lacking in this fish. This reduction of the lamina-orbitonasalis is a secondary feature and not a primitive one.

## 64. On the occurrence of Islets of Langerhans in four species of Teleosts.

H. G. KEVALRAMANI, Bombay.

In Teleostei, the islets of Langerhans are found in the form of nodules in the vicinity of the gall bladder and also between the mesentric arteries. There is generally more than one nodule. Renie termed the largest nodule as the "principal islet". The principal islet is always visible to the naked eye in most of the teleostean species. But the location of small nodules or subsidiary islets is a matter of some difficulty. An attempt was made to stain the nodules *in vivo* so that their distribution could be more easily observed. The method of staining and the position of the principal islet and subsidiary islets in the four species of shore fishes (1) *Centronotus gunnellus* (L), (2) *Zoarces viviparus* (L), (3) *Blennius pholis* (L), (4) *Cottus scorpius* (L.) have been described.

## 65. Transplantation of somite mesodrem in place of Organiser in amfibian gastrulae.

SIVATOSH MOOKERJEE, Calcutta.

The dorsal lip of the blastopore of a gastrulating newt embryo, has been replaced by the one half of a somite mesoderm of a corresponding embryo. The translocation experiments have been performed to test the inductive role of the somite mesoderm at the focal plane of the organiser centre.

The following results have been obtained:

| | |
|---|---|
| No induction .. | 7 |
| Pallisade formation .. | 29 |
| Neural tube formation .. | 14 |
| Total no. of experiments done | 50 |

The fact which emerges from the experiments, is that the somite mesodern is capable of induction and their inductive power is definitely weaker than the organiser itself. The induced neural tube, almost always surffers from lack of individuation. Certain theoretical attentions have been invited towards the failure of induction in normal development by the somite mesodern.

## 66. On the Morphology of the Male Generative Organs of the Spiny-tailed lizard *Uromastix hardwickii* Gray).

MISS S. CHAUBE, Delhi.

The male generative organs consist of paired testes; the epididymes and the vasa deferentia which finally open into the middle chamber of the chloaca, there being three successive chambers, the Coprodaeum, Urodaeum and Proctodaeum.

There are present a pair of accessory copulatory organs (the hemipenes) stowed away outside the cloaca and are visible externally as a pair of longitudinal swellings on either sides of the vent. Ordinarily they remain contracted inside sacs but are everted during copulation by special muscles. They aid in the transference of the seminal fluid into the cloaca of the female. Their walls are muscular and highly vascular.

The detailed structure of the male generative organs, the copulatory organs and the actual working of the hemipenes, are given in the paper.

## 67. Observations on follicular atresia in the ovary of *Tatera* (*Gerbillus*) *indica*.

M. R. N. Prasad, Bangalore.

The occurrence of following atresia in the ovary of the south Indian gerbill, *Tatera indica* (Family, Muridae, Subfamily, Gerbillinae) has been studied. The incidence of atresia of the follicles is high in all stages of reproductive activity including pregnancy and is noticed in follicles of all sizes. Atresia and degeneration of the follicles is due to:–

1. *Death of the eggs in small growing follicles.* The ova in the primordial follicles are the first to undergo degeneration
2. *Degeneration and fragmentation of the ovum.* In medium and large sized follicles the cytoplasm of the ovum becomes highly vacuolated and pinches off a number of small fragments. This is not normally followed by fragmentation of the nucleus
3. *Degeneration of the granulosa cells.* The cells of the membrana granulosa become highly pycnotic and swell. The swelling is sometimes so large that the cytoplasm of the cells bursts releasing the highly enlarged nuclei into the liquor folliculi.
4. *Pycnotic degeneration of the cells of the cumulus.* The cells of the cumulus cophorus undergo similar degeneration. The cells loosen and release the ovum which becomes freed and floats naked in the liquor folliculi. In the large follicles one often sees apparently normal maturation spindles.
5. *Degeneration of the zone.* The outer zona pellucida becomes swollen and highly hyalinised, followed by a degeneration of the ovum.

The oestrus cycle and the other associated phenomena in reproduction of this form are being studied.

## 68. Habits, breeding season and placentation of *Tatera* (*Gerbillus*) *indica*.

M. R. N. Prasad, Bangalore.

Our knowledge of the reproductive pheneomena of a number of Mammalian orders, especially of the tropical species, is very scanty. The subfamily Cerbillinae is one such and it has received comparatively little attention. Nothing is konown of the reproduction of any Indian gerbill. The South Indian gerbill, *Tatera indica* is a wild rat living in deep borrows on the borders of cultivated fields and feeds on grains, seed and tender saplings and causes much damage to agriculture. In a preliminary collection made so far, late pregnant stages have been secured in late April and late August. The mean litter size is 4. The young ones coming out of the burrows for the first time have been collected in May and September.

The fully formed coricallantoic placenta is mesometrially placed, discoidal, labyrinthine and of the haemo-endothelial type in the advanced stages. The giant cells are very large and form a distinct zone of 2-3 cells deep, between the labyrinthine plasmoditrophoblast and the reduced uterin myometrium. The separation of the placenta at the time of parturition occurs at this region. The yolk sac is large and retains its vascularity even in the late stages of development. Villi of the yolk sac are bathed in small pools of maternal blood at the base of the plascentral disc forming the so called "entodermal sinuses" of Duval. The yolk sac retains its primary function of nutrition along with the well developed allantoic placenta. The early development and morphogenesis of the foetal membranes of this form are being studied.

## 69. Contribution to our knowledge of the placenta in *Hyaena striata*.

### Shyama Charan Srivastava, Gwalior.

The placental morphology of some of the Arctoid Carnivores has been described by a number of investigators while this knowledge is very incomplete on the side of the Aeluroid Carnivores. In the present investigation the author has tried to bring out as much information as possible from the material collected from a single pregnant specimen of *Hyaena striata* (Family Hyaenidae).

The genital organs in *Hyaena striata* consist of a bicornuate uterus and each of its horns has a gestation sac. The foetus is fully formed and shows the development of hairs over its body. The foetal membranes are typical of the Carnivores: The amnion and the inner wall of the allantois have fused and the blood capillaries of the latter vascularise the amnion. The yolk-sac is mesometrial in position, is much less folded on itself than what it is in *Panthera tigris* or *Herpestes javanicus* examined by the author and the number of angioblasts is very poor. The structure of the placenta is horse-shoe-shaped much like that in Raccoon, and shows a wide gap on the antimesometrial side. The histological nature of the placenta is haemochorial although it is endothelio-chorial in other Carnivores. The form of villi is lamellar. The haematomes and the giant cells are absent in the stage under examination.

## 70. The occurrence and distribution of lipids in the placenta of the Indian Musk Shrew, *Crocidura caerulea*.

### N. Owers, Nagpur.

A variety of histochemical procedures were used to ascertain the presence of triglycerides saturated and unsaturated, phospholipids, and cholesterol and esters, in the foetal and maternal tissues of the uterus during the main stages of gestation.

Lipid droplets were present in all maternal tissues, epithelium of the uterus, the endometrial connective tissue cells and in the endothelium lining the maternal blood vessels. The cells of the maternal tissues appear to contain a progressive accumulation of lipids. Later these degenerate and librate the lipids. The lipid droplets appear to be absorbed by the invading trophoblast cells in the placental labyrinth. The maternal blood vessels appear to be loaded with liquid particles throughout gestation but the quantity increases gradually from the early stages and reaches a maximum amount in the later stages

The trophoblast of the bilaminar omphalopleure appears to obtain lipid material mainly from extravasted blood. Steroids are present in the trophoblast cells of the yolk sac and are not observed elsewhere in either the maternal or foetal tissues. It is therefore concluded that the trophoblast of the bilaminar omphalopleure is a source of production of the placental steroid hormones.

The physiological significance of the different lipids in the various placental constituents is discussed.

## Fishes & Fisheries.

### 71. Hermaphroditism in *Cirrhina reba* (Ham.).

A. G. Sathyanesan *and* K. Rangarajah, Annamalainagar.

An instance of occurence of hermaphroditism in *Cirrnina reba* has been recorded for the first time. This specimen was collected from the Veeranam Reservoir (S. Arcot Dist., South India) on 18-8-52. The fish measured 210 mm. in length and the gonad was in the form of a single stumpy mass; but in normal epecimens the gonad is paired. The testicular portion of the abnormal gonad is made of an enlarged anterior portion divisible into three lobes. The ovarian part of the gonad is smaller and is connected with the testicular portion with a narrow neck of tissue which ensheaths the base of the anterior part. The presence of well developed sperms in the tubules. indicates that the test is functional. The oocytes are in the second stage of development, characterised by the appearance of small vacuoles in the peripheral cytoplasm.

### 72. On the palatal lining as accessory respiratory organ in some Indian carps.

N. N. Majumdar, Delhi.

In this paper the anatomical modifications of the palatal lining of three Indian carps— *Labeo dero* (Ham.), *Crossocheilus latius* (Ham.) and *Cirrhina reba* (Ham.) are described. These modifications are in the form of a series of comb-plates, number of folds and many papillae. It also includes short description of the histology of these organs and of the experiments performed to demostrate their respiratory function.

The position of the mouth indicates that those fishes are bottom feeders. When oxygen content of water is low, there is probable need to develop some extra respiratory area. This has been achieved in the fishes mentioned above by increase in the surface area of the palatal lining by the formation of comb-plates, folds and papillae. These structures are richly supplied with blood and are constantly bathed in the respiratory current of water, and can effectively serve as acessory respiratory organs.

### 73. The Accessory Respiratory Organ of *Rita rita* (Ham.).

B. B. L. Mathur, Delhi.

The fish *Rita rita* (Ham.) has been observed to survive outside water for a considerable period ranging from three to four hours. This phenomenon, according to the author, is due to the presence of accessory respiratory organ developed in the form of palillae on the skin of the body. These papillae are in great abundance near about the bony "nuchal plate". A histological study of the skin, and papillae on it reveals a rich supply of blood capillaries inside the papillae. The blood capillaries are separated from the outside atmosphere by a single layer of epidermal cells, 4 to 6 microns thick, through which gaseous exchange can easily take place. The efficacy of the skin as an accessory respiratory organ has further been proved by experimental studies, detailed in the paper.

As this fish is generally found in the bottom of rivers and ponds, a region deficient in dissolved oxygen contents, it has developed an extra respiratory surface in the form of papillae on its skin.

## 74. Studies on the age and growth of the Malabar Sole, *Cynoglossus semifasciatus* Day.

G. Seshappa *and* B. S. Bhimachar, Kozhikode.

Detailed studies have been made on the biology of the Malabar Sole at West Hill, Calicut. The paper deals with the age and growth of this species as evidenced by a study of the monsoon rings in the scales and the percentage frequence distribution of the different sizes during the different months of the period from April 1949 to March 1952.

The bulk of the commercial catches of Soles during the years 1949-50, 1950-51 and 1951-52 consisted of individuals that had a single monsoon ring, the elder individuals being negligible in proportion. The products of spawning of a particular fishery season grow up to the commercial size and directly enter the fishery in the very next fishery season (September-October). The most frequent commercial size was 10–10.9 cm. in 1949 and 1950 seasons. It was 12–12.9 cm. in the 1951 season, thus showing a higher growth than in the previous years; this was correlated with a decrease in the total catches of the area.

There was a slight difference in the growth rate between the two sexes. The females were more numerous than the males in the highest sizes and all individuals found above 16.2 cm. were females. It appears that the females have a greater longevity than the males, but no individuals have been found in the area, with more than two monsoon rings in the scales.

## 75. Preliminary observations on the biology of some Clupeids occurring in the Andaman Waters.

V. Sadasivan, Port Blair.

In this paper an account of the Clupeids of economic importance occurring in the Andaman waters is given. An attempt of an introductory nature is also made to study the food, feeding habits, breeding habits and migratory movements of four more abundant species. They are *Clupea (H) bulan* and *Pellona ditchoa* among the Sardines and *Engraulis baelama* and *Stolephorus heterolobus*, the common Anchovies of these shores. Though they are all essentially plankton feeders, only *Engraulis baelama* seems to exercise selective faculties of feeding. A correlation between the increase in prawn larvae in the plankton and appearance of these fishes was observed. In most of these fishes breeding season seems to correspond with the advent of S.W. Monsoon but in *Clupea (H) bulan* evidence so far gathered indicates the colder months after N.E. Monsoons to be the breeding months. Data collected are in no way complete or conclusive and to obtain a fuller and satisfactory picture of their life histories more information is essential. Work on these lines is progressing in the Fisheries Research Station at Port Blair.

## 76. The histology of the alimentary canal of *Catla catla*, a herbivorous fish.

B. G. Kapoor, Delhi.

The lip of *Catla catla* is formed of epidermis and dermis, the epidermis has stratified epithelium, retemucosum of Malpighii, stratum Malpighii and basement membrane. The fibrous dermis has a prominent central core. Histology of the mucosa and sub-mucosa of the buccal lining is the same as that of the lip, only the taste-buds and mucous cells are present in large number. The mucosa of the pharynx is folded and is similar to that of the buccal lining except for a further increase in the number of taste-buds and mucous cells. The sub-mucosa has muscularis and adipose issue. The horny-pad, against which the pharyngeal teeth strike, comprises the inner superficial zone of layers of cells, folded central zone of polygonal cells and basal zone of connective tissue fibres.

The folds of the oesophageal mucosa consist of stratified epithelium with a few taste-buds and plenty of mucous cells. The sub-mucosa is reduced and contains bundles of longitudinal muscles. The muscularis is made up of circular layer of muscles only. The serosa has some subserous connective tissue bundles.

The true stomach is absent in this fish. Folded mucosa of the intestinal bulb has columnar, wandering and a few mucous cells. The free border of mucosa has three zones: the superficial zone, the canal zone and the granular zone. The sub-mucosa is reduced and muscularis has longitudinal and circular layer of muscles. The serosa is a thin layer.

The histology of intestine is like that of the intestinal bulb, only the mucous cells in the mucosa are in abundance.

### 77. On the gut-contents of *Labeo rohita* (Ham.), *Cirrhina mrigala* (Ham.) and *Catla catla* (Ham ).

R. N. MISRA, Lucknow.

This work was undertaken with a view to determine the feeding habits of those carps which are generally cultivated in the tanks of the Uttar Pradesh State and thus help the pisciculturist in providing the right type of food in this tanks. One hundred and thirty guts were opened and the contents were examined microscopically. From a study of the gut-contents it has been deducted that *Labeo rohita* is a bottom feeder, *Cirrhina mrigala* is a middle feeder and *Catla catla* is a surface feeder. These conclusions point out that all these carps can be cultivated together in a tank.

### 78. On the gut-contents of a few predaceous fishes.

R. N. MISRA, Lucknow.

To study the comparative destructive nature of some predaceous fishes commonly found in tanks in the Uttar Pradesh, four hundred and eighty guts of *Wallangonia attu* (Bloch), *Mystus seenghala* (Sykes), *Ophiocephalus marulius* and *Ophiocephalus striatus* (Bloch) were examined microscopically. It was found that *W. attu* is the most highly predaceous fish and feeds entirely upon small fishes; *M. seenghala*, *O. marulius* and *O. striatus* also feed upon fishes but not to shch a large extent; *R. rita* does not feed upon fishes at all and it takes in water insects, crustaceans, blood worms and limpets.

It is therefore essential that before stocking a tank with fingerlings of carps, the predaceous fishes mentioned above should be removed by neeting the tank completely.

### 79. Food and feeding habits of *Coilia dussumieri* (C.V.).

M. S. JOSHI *and* D. V. BAL, Bombay.

*Coilia dussumieri* is a common food fish of Bombay caught all along the Bombay coast throughout the year. During the year 1950-51, its food and feeding habits were studied, and the results lead us to the following conclusions.

The examination of the stomach contents of this fish reveals that it is a plankton feeder. The presence of long and numerous gillrakers, and fine uniform teeth on the jaws also indicate its plankton feeding nature. It is mainly carnivorous and the important organisms that go to form its food are, copepods, prawns, fish-larvae, cypris, stomatopod-larvae, mysis, polychaete-larvae, and isopods.

It is further observed that the feeding of juvenile fish (up to 14 cms.) and adult fish differs considerably. The juvenile fish mainly depends on copepods and prawns while the food of the adult is also composed of other organisms like fish larvae, polychaetes, cypris etc. The copepods form usually a lesser percentage. The type of food organisms taken in by both juvenile and adult also differ according to the seasons.

## 80. On the role of Zooplankton in nutrition of carp fry

G. N. MITRA *and* P. MOHAPATRA, Cuttack.

In order to determine the role of zooplankton in the nutrition of carp spawn, tanks were kept under observation and records regarding plankton and rate of stocking were kept along with the ultimate yield of fingerlings. The results obtained in the field have been compared with those in laboratory experiments in aquaria. It has been generally seen that zooplankton provides natural nutrition for the fry in the earliest stages but the concentration in the tank has to be about 8 to 10 times than in the aquarium for comparable results. Higher availability of zooplankton is responsible for increased percentage of survival but to obtain the highest yields in weight it is necessary to adjust the rate of stocking to the quantity of zooplankton. It has been suggested that zooplankton combined with a concentrated food like oil cake is useful for rearing fry. Use of cow dung is detrimental in the nutrition of fry and phytoplankton like *Volvox* exercises an adverse affect.

## 81. Bacteriology of fresh water fish. I. The bacterial flora of Mettur fish.

R. VENKATARAMAN, A. SREENIVASAN *and* S. T. CHARI, Kozhikode.

The bacterial flora in the flesh of a South Indian carp, *Cirrhina cirrhosa* has been studied. Their morphological and cultural characters as well as their biochemical reactions were observed. Fluorescent rods were conspicuous by their absence. The dominant strains were *Achromobacter* and *Alkaligenes* followed by *Micrococcus*. *Flavobacterium*, *Paracolo-bacterium*. *Proteus*, *Escherichia intermedium* and a *Bacterium* were the others encountered. Compared with our studies on the bacteria in marine fishes, we find a greater variety in fresh water fish. The occurrence of a number of slow lactose fermenters and *Proteus* is interesting. In the flesh of *Cirrhina* we did not find any aerobic sporeforming rods, contrasted with the large numbers we found in Mackerels. (Venkataraman and Sreenivasan 1952). As in the case of the flora of marine fishes of our coasts, even in the case of the fresh water fish, we could explain the poverty of *Pseudomonas* by the high temperatures of the tropical waters.

## 82. Studies on the storage of fishmeal in sealed tins.

R. VENKATARAMAN, A. SREENIVASAN *and* A. G. VASAVAN, Kozhikode.

Fish meal was packed in sterile tins with and without passing Nitrogen and sealed. Periodical observations and analysis were done up to six months. The moisture content was constant but the fat decreased and free fatty acids increased in agreement with the observations of Whitmore et al (1948). The bacterial count and T.V.B. were almost unchanged till 2 months but increased in the third month and remained fairly steady till the 5th month after which there was a fall in bacterial count nearing the initial value. As noted by Hay and Pearce (1946) the N packed samples showed slightly beneficial effects than air packed samples. Mould growth was not observed but the small of ammonia was discernible by olfactory sense after 4 months. In view of the low cost, Nitrogen packing may be recommended for fishmeal storage in sealed tins.

## 83. Studies on salting of marine fishes of Malabar Coast with special reference to the ratio of salt to be used.

R. Venkataraman *and* A. G. Vasavan, Kozhikode.

A series of experiments were carried out to assess the standards in salting of different marine fishes with reference to the ratio of salt to be used for different sizes of fish in Wet and Dry seasons. The fish after gutting and cleaning were cured in different ratios and the dried products were kept under observation. Observations on spoilage were made both by organoleptic tests and chemical tests. The Chemical test was for $H_2O$, T.V.B. and NaCl. Based on the keeping quality of the product the ratios of the salt to be used for different varieties of fish in the wet and dry season were prescribed. The ranges of NaCl, $H_2O$ and T. V. B. for quality product are also prescribed.

## 84. Isolation of Trimethylamine oxide in some Indian marine fishes.

R. Venkataraman *and* S. T. Chari, Kozhikode.

In continuation of a previous communication of ours (Proceedings of the 39th Indian Science Congress, Part III Abstracts—Section No. 7, p. 329, 1952) the presence of Trimethylamine oxide in the muscle of the following marine fishes has been proved:– White Sardine (*Sardinella fimbriata*), Horse Mackerel (*Caranx crumenopthalmus*), Shark (*Carcharias acutus*), Skate (*Rhinoptera sp.*), Perch (*Serranus diacanthus*), Seer fish (*Cybium commersonii*), Jew fish (*Sciaena coiter*), and Sole (*Cynoglossus sp.*). The tertiary oxide has been isolated in all the above cases, as a picrate, whose melting point was found to be 197–202°C. with decomposition. Further work on the isolation in other fishes as well as quantitative estimation of the oxide are in progress and will be communicated elsewhere.

## 85. On the utility of sodium phosphate in the transport of fingerlings of Indian carps.

R. Srinivasan *and* P. I. Chacko, Madras.

The existing method of fish-seed transport in Madras in open tin carriers involves changing of water at frequent intervals and very often entiails a high percentage of mortality. The depletion of dissolved oxygen and accumulation of carbon-dioxide are known to be the twin factors responsible for the mortality. Buffers like secondary sodium phosphate ($Na_2HPO$) are noted to remove the accumulated carbon-dioxide. By a series of experiments it has been found that the addition of secondary sodium phosphate does not decrease the mortality of Indian carp fingerlings during their transport in ordinary open tin carriers probably because the main problem in this case is one of replenishment of oxygen rather than removal of carbon-dioxide; but that the addition of 1.5 gm/litre of sodium phosphate considerably reduces the mortality of fish when transported in sealed oxygen tin carriers as in this case the accumulation of carbon-dioxide is mainly responsible for the death of fish.

## 86. Total fish-yield from a stocked tank in the Uttar Pradesh State.

### A. J. Faruqi, Lucknow.

With a view to determine the fish yield from a tank stocked with carps like *Labeo rohita, Cirrhina mrigala* and *Catla catla*, a record was kept of the number of fingerlings introduced and the total fish yield from a tank. These data have been collected from a one-acre tank known as 'Garha' and which is situated about ten miles from Lucknow on the Lucknow-Rai Barielly road. Fingerlings of the three carps mentioned above were introduced in two batches, the first batdh of 3,165 was stocked on the 13th March 1949 and the other of 1,210 on the 13th January 1950. Neetting was started from the 17th June 1950 and was continued till the 27th July 1951 when almost all fish was taken out. The total weight of fish taken out was 3 mds. 12 srs. 12 chhataks and the entire fish was sold in the local market and fetched Rs. 1,085/10/6.

## 87. A preliminary report on the mud-skippers of Bet (Okha Mandal)

### G. P. Sharma Hoshiarpur.

In December 1951, a party consisting of three members of the staff and ten students from the Zoology Department of the Panjab University visited Okha for the study of marine zoology. In their huge collection of marine animals there were six mud-skippers. These were collected from the muddy shores on the island of Bet in the gulf of Kutch. On subsequent examination at Hoshiarpur five of these specimens were found to belong to the genus *Periophthalmus* and the remaining one was identified as that of *Boleophthalmus tenuis*. Due to the lack of literature it has not been possible to get up to the species so far as the five specimens of *Periopthalmus* are concerned but the results of their detailed study are given in the body of the paper. It may be stated that there is no mention of these mud-skippers in the two volumes of the Fauna of Okha Mandal. Even in the list of marketable fishes maintained by the Fisheries Department sub-station at Okha only the name of *Boleophthalmus tenuis* (locally known as "Gulo") is included.

# 40th INDIAN SCIENCE CONGRESS, LUCKNOW, 1953

## SECTION OF ENGINEERING & METALLURGY

PRESIDENT: S. K. SARKAR, M.Sc., Ph.D., A.R.S.M., D.I.C.

## *Abstracts*

### 1. Atmospheric Noise

S. V. CHANDRASHEKHAR AIYAR *and* K. R. PHADKE

Extensive observations are available on the physical aspects of atmospheric noise. But the data is not of much quantitative significance from the engineering point of view. For this purpose, we need to know the atmospheric noise level on a given wavelength which would affect a receiver turned to a band width of 6 Kcs. or 10 Kcs. This data is of value for evaluating the desirable field strengths at different places on different wavelengths and hence the power and location of broadcasting station. Further, only that part of the noise that gives an A. F. in the 100 to 5000 c/s band is of direct interest to the Engineer. Based on these ideas, an atmospheric noise measuring equipment has been built and set up.

The band of great interest for Indian broadcasting is the 30 to 90 metre band. In this band, even the physical data is scanty. Hence, measurements on atmospheric noise in this band, particularly at 31 m, 60 m and 89 m are being carried out. The period of day of interest is the time during which the AIR stations are on the air. Both average and peak values are of direct interest. The equipment records both. The preliminary results obtained are presented in this paper.

### 2. Field strength measurements on Ultra-short Radio waves

S. S. BANERJEE, P. C. BANERJEE *and* V. D. RAJAN, Banaras.

Field strength measurements have been made at various distances in radial directions around a low-power ultra-short wave transmitter both for vertically and horizontally polarized waves. These observations show the effects of obstacles such as buildings, trees and electric poles on the propagation of these waves by the anomalous variation in the field strength observed in those directions where such obstacles are located. Interference patterns due to multiple reflection between walls and buildings have also been obtained. Contour maps of field strength variation have been plotted for various distances and directions.

Mathematical equations connecting the field strength at any given distance from the transmitter, the soil constants of the region, viz., the dielectric constant and the conductivity, and the wavelength of the radiation have been developed both for vertically and horizontally polarized waves. The curves of field strength variation with distance have been plotted on the basis of the equation for various sets of values of dielectric constant and conductivity. Comparing the theoretical curves with the practical ones as obtained from the field strength measurements, the values of the soil constants have been determined.

## 3. Field strength measuring Equipment

S. V. CHANDRASHEKHAR AIYAR *and* R. D. JOSHI

Short wave broadcasting in the 30 to 90 m. band is of great importance to Indian broadcasting. A systematic study of the received signal of stations in this band is of considerable interest and importance. For this purpose, the geographical North-South and East-West have been accurately marked. Aerials, horizontal in the N-S, horizontal in the E–W and vertical have been set up and their constants evaluated. A stray pickup free feeder system has been set up. The equipment built up has been calibrated to read directly the field strength in UV/metre. Using this equipment the intensity of the field as affecting the three aerials and due to different AIR stations have been observed at intervals of half hour. The results obtained reveal interesting facts regarding relative intensity in the different directions, fading etc. These are presented in the paper.

## 4. Effects of electrical potentials on physical and chemical reactions

G. P. CHATTERJEE, Howrah.

Most of physical and/or chemical reactions take place either at the surface of a medium (more correctly in the interfaces between two media) or within the volume of the medium or both. Some of these reactions may remain more or less limited to the "surface-zone" and profoundly influenced by "surface-properties" while many others sooner or later, get extended into the "volume-zone" of one or both media primarily by the process of "diffusion". In fact almost all "volume-zone" reactions have in some way or other their origin at some surfaces or interfaces.

While the extact mechanism of the phenomena occuring at surfaces or interfaces are far from being clearly understood an attempt has been made in this paper to throw some light on some of the underlying phenomena on metal surfaces and to find out the effects of charging the surfaces to different potentials with particular reference to the initial stages of oxidation on polished steel surfaces.

The following results have been obtained.

(1) The activity of a metal surface is affected by changing the potential of the surface e.g., the rate of formation of oxide film on a polished steel surface is reduced by charging it positively or negatively.

(2) This reduction in the activity appears to be due to the reduction of tension on the surface owing to repulsive forces brought about by similar charges (either positive) or negative on the surface.

(3) The activity of the positively charged sample is greater in the initial stages but becomes less than the negatively charged specimen at a later stage.

(4) The inverse of time $t$ required to form a given thickness of film appears to be an exponential function of the absolute temperature viz.

$-E/kT$ where $E$=activation energy

$k$=Boltzmann constant

$T$=°$K$

$$\frac{1}{t} = k_0 e$$

Thus $\log \frac{1}{t}$ plotted as a function of $\frac{1}{T^{\circ}K}$ gives a measure of the value of the activation energy *E*.

It has been indicated that carburisation, decarburisation. oxidation, nitriding, malleablishing, diffusion, catalysis and a host of other reactions may be accelerated, inhibited and therefore controlled by a suitable choice of potential. Further work on this line is being carried out.

## 5. Vibration of overhead Transmission Lines

J. K. CHOUDHURY, Jadavpur.

1. An introduction to the phenomenon of vibration of overhead transmission lines: How vibrations are formed: Relation with corona, etc., uncertain. Equation for frequency, loop length, velocity of the vibration wave: Details of amplitude and other factors concerned with vibration. Breakdown of the conductors due to vibration.

2. Effect of tension on conductors: Tight and slack tension: Whipping, Dancing.

3. Means of minimising vibrations: Design of supports: Clamping: Shape of conductors: Armour rods, Dampers.

4. Study of vibration with particular reference to Indian and specially West Bengal climate conditions.

5. Conclusion: It is desirable to have higher tension than at present recommended for the Indian Union: Economy obtained by higher tension should not offset by greater number of failures: Field work under actual climatic conditions of the Country essential.

## 6. Effect of Fault Impedance on the Measured Impedance of Distance Relays

H. V. RANGACHAR *and* C. S. GHOSH, Bangalore.

In the case of transmission lines, it has been usual to assume linear variation of the line constants with the length of the line, especially in the case of analysis for relay operation. It is also well established that the actual relation for transmission lines, especially long lines, is hyperbolic and the former assumption yields only an approximate result.

In this paper, a rigorous hyperbolic method has been adopted, which gives better facility to discuss the effect of the fault and its impedance on the impedance measured by the relay. The effect of fault impedance is discussed in detail and the points of difference from the usual method indicated. How the fault impedance affects the measured impedance and hence the operation of the relay is also indicated.

## 7. Engineering services under State Administration

J. N. BASU, Jadavpur.

The total revenue receipts of the West Bengal State is rupees 35.91 crores from the following : Agricultural, Income-tax, Land Revenue, Excise, Duties, Stamps, Receipts, under Motor Vehicles Acts, Other taxes, Registration Forest, Shae of centrally levied taxes, Intensive Food Production Schemes, Road Development Fund. The expenditure under the engineering services alone as stated in the Table I amounts to Rs. 27.07 crores. The total expenditure of the State is estimated at Rs. 41.11 crores.

TABLE 1

| | | |
|---|---|---|
| 1. | Irrigation & Water ways .. Rs. | 1,77,10,000/- |
| 2. | River Valley Projects | |
| | (a) Damodar Valley .. | 11,19,64,000/- |
| | (b) Mayurakshi Project .. | 4,14,74,000/- |
| 3. | Civil works | |
| | (a) Civil works .. | 4,37,94,000/- |
| | (b) Civil works under different services .. | 2,40,17,000/- |
| 4. | Engineering services under intensive food production .. | 71,70,000/- |
| 5. | Electric Supply .. | 42,73,000/- |
| 6. | Road Transport .. | 47,17,000/- |
| 7. | Deep-sea Fishing by trawler .. | 2,01,000/- |
| 8. | Printing & Stationary .. | 7,34,000/- |
| 9. | Industrial Development .. | 36,20,000/- |
| 10. | Planning Community Projects & New town Development | 1,10,29,000/- |
| | Total Rs. | 27,07,09,000/- |

The engineering services amounts to $\frac{27.07}{35.91}$ i.e., 75% of the revenue receipts and $\frac{27.07}{41.11}$ i.e., 66% of the expenditure of the State.

The Legislative Assembly is the body empowered not only with enactment of legislation, but also to formulate working policies to administer the State along with improvement of social and economic structure.

The West Bengal Legislative Assembly constituted by 240 members, has only 2 engineers amongst them, that is only 0.835% of the total number.

For such a State of affairs, I do not intend to accuse any other except my colleague-engineers, who for some reasons or other do not like to tread into this field of activities, though the activities entails much engineering works necessitating engineering techniques to be greatly exercised. I wish the engineers of the country will be enlightened with the sense of responsibility to fulfil their obligation with respect to the betterment of the social and economic life of the nation.

## 8. A Note on the Washing of Indian Coals

J. W. WHITAKER, Manbhum.

Attention is drawn to the relative differences in yield obtained by washing the coal screened and unscreened, and, in particular, to the general desirability of washing the coal unscreened in order to improve the yield. The washed fines contain very low ash, and the inclusion of a quantity of such high quality coal washed along with the larger coal, has the effect of increasing the percentage yield of washed coal, of stipulated average ash, by 10 to 20 in many cases.

## 9. Heats of Wetting of Indian Coals

S. R. Ghosh, K. A. Kini, N. N. Das Gupta & A. Lahiri, Manbhum.

The heats of wetting (in methanol) of various Indian Coals selected from the Jharia, Raniganj, Bokaro-Ramgarh-Karanpura, Giridih, Assam and Vindhya Pradesh Coal-Raniganj, Bokaro-Ramgarh-Karanpura, Giridih, Assam and Vindhya Pradesh Coal fields have been measured and correlated with the rank of the coals as determined by their moisture, volatile matter, carbon content, etc.

The heats of wetting of coals have further been found to be useful in the assessment of the 'coking' or 'coke-making' properties of the coals. The physical properties of the cokes (as indicated by Conventional Shatter and Tumbler Tests) obtained from the coals have been shown to have a closer relationship with the heats of wetting than with the empirically determined Caking Index Values of the coals. On the basis of of their heats of wetting, the Indian coals have been classified into four general groups for their coke-making properties:

(1) Strong to medium coking coals with heats of wetting of 4–7 Cals/$_g$ d.a.f. and yielding 'hard' to 'medium hard' coke on carbonisation e.g., Barakar Measure coals of the Jharia and Raniganj fields, Lower Karharbaree seam of the Giridih field and Kargali seam of the Bokaro field.

(2) Medium to weakly coking coals with heats of wetting of 7–10 Cals/$_g$ d.a.f. and yielding 'medium hard' to 'soft' coke on carbonisation: e.g.,
   (a) Raniganj Measure coals of the Jharia field and
   (b) (i) Raniganj Measure coals of the Raniganj field (from Dishergarh and Sanctoria seams),
      (ii) Assam (coking type) coals.

(3) Poor coking coals with heat of wetting of 10–14 Cals/g d.a.f. and yielding 'soft' coke on carbonisation, viz.; Raniganj Measure coals of the Raniganj field (Poniati seam).

(4) Non-coking coals with heat of wetting of 15 Cals/$_g$ d.a.f. and over, yielding pulverulent residue on carbonisation, viz., non-coking coals of all coal fields.

Although the correctness of the absolute surface area of coals obtained by the heat of wetting method has of late been disputed, the heats of wetting nevertheless provide a reliable guide to the classification of coals according to rank and predicting the general industrial behaviour, particularly on carbonisation.

## 10. Recent developments in the Combustion of Pulverized Coal

B. Ghosh, Calcutta.

At the present time pulverized coal is being widely used as a fuel for power generation in all technologically developed countries of the world. Recent investigations have thrown a considerable light on the mechanism of flame formation with pulverized coal and it appears that the burner-mouth velocity for maintaining stable flame position depends on the size of the flame. For efficient combustion within a comparatively small space grid and multi-jet burners have been developed in which the primary streams of coal dust and air are surrounded by streams of secondary air. Pulverized coal fired gas turbines have been developed. For open cycle operation cumbustions under pressure is called for and this necessitates feeding coal dust under pressure and also removing fine ash particles from the products of combustion. Both these problems have been solved. Experimental furnaces with high heat release (over 3 million Btu. ft. 3/hr.) have been built on the vortex principle; also cyclone combustors have been disigned. This paper reviews these newer methods of pulverized coal cumbustion and stresses the necessity of introducing the techniques of pulverized coal firing in India.

## 11. Effect of Weathering on Non-Caking Coals

R. Vaidyeswaran, B. S. Narayana Rao *and* M. S. Iyengar
Hyderabad, Dn.

Non-caking coals from Tandur and Kothagudium collieries were stored for about a year. Results of proximate analyses and Gray King Carbonisation Assay at 600°C. of samples drawn at regular intervals are reported. After about six months' storage, tar-yield decreased while gas-yield increased. There is a deterioration in the strength of coal after about six months and this effect was noticed more in the coal at the surface.

## 12. Humic Acid by Fluidised Oxidation of Non-caking Coals.

D. P. Agrawal *and* M. S. Iyengar, Hyderabad, Dn.

Controlled oxidation on non-caking Tandur Coal was carried out at 180°C. and 220° C. in a fluidised bed for about three weeks and its effect on the production of Humic Acid and increase of Carboxylic group in coal were studied. Oxidation at higher temperature increases the yield of Humic Acid and decreases the time required for oxidation. Experiments carried out at 220°C. on fluidised oxidation of coal, yielded 78..1% Humic Acid on pure coal basis after 312 hours

## 13. Washability of High-Ash Caking Indian coals in the Heavy Media Separation Unit

K. Ramalingam, K. S. Murthi and M. S. Iyenger, Hyderabad, Dn.

The possibilities of washing high ash caking Indian coals in a 500 lbs./hour capacity Heavy Media Separation Unit designed by American Cyanamid Co. were investigated and the results compared with those obtained in the laboratory by the usual float and sink method using a heavy liquid. It was found that the yields in the heavy media plant were 2 to 5% higher than those obtained in the laboratory.

## 14. Studies on the reduction of Phosphorus in Indian Pig Iron by the Basic Convertor Process.

G. P. Chatterjee *and* P. C. Kundu, Horwah.

The Basic Converter Process of making steel essentially consists of blowing air through a mass of molten pig iron containing about 1.0% *Si*, 0.8% *Mn*, and 2 to 3% *P*. The oxidation of the *Si* and *Mn* supplies the heat in the initial stages of the blow while the oxidation of *P* supplies the heat during the so-called "After-Blow" period. Indian pig iron contains about 0.3% *P* and is therefore ordinarily not suitable to be made into steel by the basic converter process. Suggestions and attempts have been made to increase the *P*-content of the pig iron by charging phosphate-bearing materials in the iron blast furnace. But for several reasons the process could not be made successful—primarily due to want of heat during the "After-Blow". An attempt has been made in this investigation to overcome the deficiency of heat by enriching the blast with oxygen and at the same time controlling the temperature so as to retain some *Mn* during the "After-Blow" and effectively reducing the *P*-content. Whether or not such a process may be made industrially successful depends on other factors. Theoretical considerations and the new tool of controlling the temperature by enrichment of the blast deserve a fresh approach to the problem—particularly because a lower phosphorus-content of the Indian pig iron needs a much lower consumption of lime.

## 15. On dephosphorisation of Ferrophosphorus in Hydrogen

P. C. Ghosh *and* B. Chatterjee, Sibpur.

On heating ferrosphosphorus for 4 hours at 1000°C. under flowing hydrogen and nitrogen a small but definite removal of phosphorus has been observed. Hydrogen has been found to be more effective than nitrogen in bringing about dephosphorisation. This process involves (i) a loss of phosphorus due to diffussion and volatilisation and (ii) an interaction between ferrophosphorus and hydrogen. The introduction of moisture in the annealing gases greatly speeds up the dephosphorisatno process in both nitrogen and hydrogen. The effect of water is probably due to its (i) direct reaction between ferrophosphorus and (ii) interaction with the gaseous products involved.

## 16. Oxidation characteristics of High-Carbon Steel at different Potentials.

K .C. Shome, R. Ganguly *and* G. P. Chatterjee, Howrah.

It is well known that a piece of iron or steel oxidises when left exposed to air. The rate of oxidation increases with increasing temperature. While the exact mechanism of oxidation is not clearly understood, the process essential consists of (i) a surface reaction between the oxygen molecules and the iron atoms and (ii) diffusion of the oxygen and iron atoms. An attempt has been made in this investigation to find out the effects of electrostatic potentials on the oxidation characteristics of high carbon steel.

The following results have been obtained:

1. The rate of oxidation of a neutral high carbon steel specimen is greater than that of a positively or negatively charged specimen (charged to ± 12 volts in this investigation).
2. The positively charged specimen is more reactive in the initial stages of oxidation than the negatively charged specimen.
3. The negatively charged specimen becomes more reactive in the later stages.

## 17. Studies on the Oxidation-Resistance of Iron by Alitising

G. P. Chatterjee, Surajdeo Prasad, Howrah.

Alitising is the process of impregnating the surface of metals and alloys (usually iron and steel) with Aluminium by solid diffusion at high temperature with the primary object of increasing the resistance of the alloy against corrosion.

In this investigation Armco iron was alitised and its resistance against oxidation at high temperature were studied.

The experimental procedure consisted of:—

(1) Preparation of the Fe-Al compound.

(2) Heating the iron specimen to a high temperature surrounded with Fe-Al compound powder to get the Al-impregnated layer,

(3) Examining the treated specimens under the microscope and also test its relative resistance against scaling at high temperatures.

The following results were obtained:-

(1) Aluminium has a comparatively high migration velocity particularly at the Alitised temperature (1000°C.).

(2) No brittle compound was formed, as the percentage of Al concentration at the surface layer was not high.

(3) Alitised layer has a good resistance against scaling.

## 18. 'Some Observations on the Effects of Titanium on the Ageing Characteristics of some Aluminium-Copper Alloys

A. K. Chatterjee *and* D. P. Chatterjee, Howrah.

It is well known that considerable changes in the properties of aluminium and other alloys can be brought about by some specific isothermal treatments, like "ageing". The age-hardening series of aluminium alloys (like duralumin, etc.) are too well known. Duralumin contains among other elements (like magnesium, silicon, etc.) nearly 4.0% copper. India is rather poor in copper ore but fairly rich in the ore minerals of titanium. An attempt has been made in this investigation to observe the effects of titanium on age-hardening characteristics of an aluminium alloy containing about 2% copper. For obvious reasons the development of age-hardening group of Al-alloys with lower % of Cu has immense potentialities for this country. Moreover theoretical considerations indicate that small amounts of titanium may be helpful for this purpose. The following results have been obtained in this investigation:-

(i) the alloy with 2.1% Cu and 0.4% Ti shows good age-hardening characteristics;

(ii) the incubation period is very appreciably reduced by the presence of small amounts of titanium;

(iii) there appears to be a critical degree of straining below which the hardness of the alloy progressively decreases on ageing but above which the initial drop in hardness is followed by a subsequent rise to a peak, followed by the usual decrease towards a more or less steady value asymptotically.

## 19. Studies on the Grain Growth of Alpha-Brass under a Temperature Gradient Condition.

S. C. Some *and* G. P. Chatterjee, Howrah.

Almost all mechanical properties and some of the physical properties of metals and alloys are functions of their grain sizes. Though fine grained materials are usually preferred for their better mechanical properties, course grained materials are sometimes desirable particularly for better machinability, greater hardenability and sometimes for greater resistance against creep. For non-ferrous alloys, the results of various investigators particularly on the rate of grain growth of alpha brass do not agree quite well. Moreover, the rate of grain growth under the condition of a temperature-gradient has not so far been studied. An attempt has been made in this investigation to indicate some fundamental concepts on the grain growth and to observe the rate of grain growth of alpha brass as functions of time and temperature under a known temperature-gradient condition. The following results have been obtained:-

(1) The law of grain growth for the alpha brass at a given temperature may be represented by the equation

$$D=Kt^n$$

even under a temperature-gradient condition, where $D$=average grain diameter, $t$=time and $K$ and $n$ are constants at a given temperature.

(2) The index $n$ remains fairly constant between 400 to 500°C. at $n=0.23$.

(3) The value of $n$ increases from $n=-0.23$ at 500°C. to $n=0.40$ at 750°C.

(4) The energy of activation $E$ given by the equation

$$D=A\,e^{-E/KT}$$

increases with increasing temperature $T$ where $K$=Boltzmann constant, $A$= constant.

## 20. A new Type of Crucible Press

K. K. MAJUMDAR, Dhanbad.

A new type of crucible press of the screw type having a rotating plunger and a stationary mould has been developed for pressing graphite crucibles. It has many improved features over other presses described in literature so far. The mould is covered with an annular disc with a central opening just sufficient to accommodate the plunger. The disc is kept pressed against the mould by means of powerful springs operated through 4 long rods, all being fitted into a platform attached to the screw to which the plunger is fitted. During pressing, excess clay in the mould cannot escape freely as in the conventional types of presses, but is subjected to powerful pressure by the springs, the intensity of which increases as the plunger descends. This helps to make the crucible dense and free from laminations.

Another new feature is the fitting up of a poppet valve at the bottom of the plunger, the latter being drilled right through, which allows air to get into the void created by the ascent of the plunger after completion of pressing. This helps to prevent deformation of the green crucible.

The disc covering the bottom of the mould which is used for lifting the pressed crucible is also perforated, so that entrapped air may escape easily. The inside of the mould is covered with a piece of cloth to prevent adhesion. The mould and the plunger were made of cast iron.

## 21. Iron as a Catalyst in the Decomposition of Carbon Monoxide

P. P. DAS *and* B. CHATTERJEE, Sibpur.

The catalytic activity of iron in bringing about decomposition of carbon monoxide decreases progressively tending to zero when carbon monoxide is continuously passed over iron oxide heated at 550°C. a temperature at which maximum deposition of carbon has been reported. Treating the used-up catalyst at 900°C. in an atmosphere of hydrogen restores its activity to some extent. Regeneration of the spent-up catalyst has been found to be very low on heating it in hydrogen at temperatures below 700°C. The activity of the metal obtained from the oxide by reduction as also of the pure iron progressively decreased on treating them in an atmosphere of hydrogen at increasing temperatures. Similar reduction in the activity of pure iron has been observed on heating the metal in nitrogen. This observation has been corroborated by using iron obtained by the reduction of ferrous oxalate in hydrogen. The higher the temperature of decomposition, the lower is the activity of the iron powder produced. Hydrogen and nitrogen act as inhibitors in the decomposition of carbon monoxide catalysed by iron. The decrease in the activity of the iron catalyst on heating in hydrogen and nitrogen probably arises from the sintering of the metallic ir .

### 22. Utilisation of Sludge from the Acetylene Industry for Making Building Bricks

B. S. R. SASTRY, Hyderabad. Dn.

The sludge left over after the generation of acetylene from calcium carbide consists mostly of calcium hydroxide. This sludge when mixed with suitable proportions of graded sand or coal-ash and pressed into bricks which are subsequently autoclaved in steam yield bricks possessing high crushing strength. The compressive strength of the bricks increases with increase in proportion of sludge.

### 23. Naval Architecture with special reference to India

SAROJAKSHA BASU.

With the attainment of Independence and the consequent need to maintain fleets of our own for Merchant Shipping and Defence of our Coasts and Sea Routes there has opened out a vast field for research in Naval Architecture to investigate methods of economising cost of building, running and maintaining vessels. The directions in which research is most needed are pointed out and a suggestion is made for the establishment of a Towing Tank for Model Experiments in this country to air the research on problems of Resistance and Propulsion of Ships as yet unsolved or unpublished in other countries.

### 24. The Theory of Matrix Dissolution

S. M. DAS GUPTA, Delhi.

In a previous paper (Proc. Ind. Sc. Cong., part III, 1950, page 175) some aspects of formaulation of antifouling of ship-bottom paints were studied. In the present paper, studies have been made on the leaching rates of toxic (Curo), as well as matrix (containing resin—an acid resin) in a typical antifouling paint, in the light of the theory of matrix dissolution recently put forward by Ketchum and others (J. Ind. Eng. Chem. Vol. 38. p. 1931, 1946). According to this theory, the dissolution of the matrix constantly exposes a fresh surface of toxic for necessary action. It has been found, however, that under laboratory conditions, when the artificial sea water, containing 1.7 per cent sodium chloride, remained practically undisturbed, the leaching rates of both toxic and matrix are adversely affected and the actual quantity of either gone into solution remained practically constant (2.15 m/cm$^2$/day) for about three months due to formation of an insoluble film of paraffin on the surface of the antifouling paint. On removal of the film surface by mild abrasion, the paint again exhibited steady leaching rate (4.45 m /cm$^2$/day) of both toxic as well as well as the matrix. The current of the sea perhaps serves the same purpose as the artificial abrasion mentioned above.

## 25. Colloidal Graphite as an External Lubricant in Internal Combustion Engines.

G. Ramarao, Hyderabad, Dn.

In most of the internal combustion engines like petrol, kerosene, and Diesel engines the big end bearings of the connecting rod are fairly well lubricated by the pump which forces the oil through the crank shaft. But surfaces which are exposed to more serere conditions of temperature and pressure and which consequently require more lubricant like the cylinder walls particularly the upper half, the gudgeon pin receive only a small quantity of it. The present work is an attempt to remedy this by smearing the cylinder walls, the piston particularly in the grooves in which the rings are fitted, the gudgeon pin and also the crank pin with 'Oildag' a proprietory compound containing colloidal graphite suspended in an oil medium. The improvement in the performance of a 6 h.p. Ruston-Hornsby petrol paraffin engine was studied. The indicator diagrams at various loads reveal very interesting results and the mechanical efficiency and the fuel consumption per b.h.p. hour showed considerable improvement. Further work is in progress.

## 26. Boundary Correction of Mohr Theory on Cohesive Soil and its Application to the Problem of Retaining Wall

S. P. Baidya, Maithon.

According to Mohr, cohesion is tan $\theta$ times the intrinsic pressure developed by an external load. This made his rupture line continuous in the cohesive part of a soil. In fact friction develops under normal reaction among the particle in a soil after the failure of its cohesion. With the increase of deforming stress the deformation characteristic of the cohesive medium changes gradually from elastic to plastic at its failure and corresponding stress diagram changes from elipse having a constant major axis equal to 2c in magnitude to circle of radius c. Shear pattern during the deformation moves parallel to each other maintaining an angle 45° to the direction of principal stresses. In the case of vertical retaining wall deforming force increases with depth, the stress diagram becomes circle at the transition between tensile and compressive zone. In unconfined condition normal reaction to shear plane is zero so friction is zero. In Triaxial compression shear pattern orient from 45° to $(45^\circ + \theta/2)$ at failure with the orientation of the frictional particle under the increased deforming force. In the case of vertical wall failure anglecorresponds to the deforming force at depth below the tensile zone at which the pressure to retain the earth in the wall fails.

## 27. Assessment of Seepage Losses in Channels with a Fall

K. P. Shukla, Roorkee.

In general the seepage losses in earthen channels depend upon the permeability of soil and difference of hydrostatic head between the water level in the channel and the sub-soil water level. The sub-soil water level adjacent to channel with a fall, however is not constant and the losses, therefore, are variable and to determine them correctly, its exact shape is required to be found out. The problem of assessment of losses in such channels thus, involve the determination of permeability of soil, a relation between losses with the depth of sub-soil water level below the water surface in the channel and the relation between the distance along the channel and the depth of sub-soil water level.

The existing channel at Bahadrabad Power House has a fall of 18 feet and it was proposed to find out loss in the power channel reach. Sub-soil water levels were observed along the channel in a reach of 3500 feet and on correlating distance with depth it was found that the curve is semi-cubical parabola with the following equation:

$$S\ a_0 + a_1(x-18) + a_2(x-18)^2 + a_3(x-18)^3 \qquad .. \quad (1)$$

Where $S$=depth of sub-soil water level in feet.
$x$=distance in hundreds of feet.

$a_0$, $a_1$, $a_2$ and $a_3$ are constants and are equal to 116.7299, 27.1461, 2.31566 and 0.063 respectively.

Variation of losses $q$ per foot width of channel with the depth of spring level $S$ was studied by model experiments and following relation with regard to the soil found here was worked out:

$$q = 3.3x10^{-4}\ S^{0.99} \qquad .. \quad (2)$$

To simplify calculations the exponent of $S$ is taken as unit and the equation reduces to

$$q = 3.3x10^{-4}\ S \qquad .. \quad (3)$$

The losses $Q$ in the whole reach of 3500 feet are thus calculated as

$$Q = \int_0^{35} q\,dx$$

$$\int_0^{35} 3.3x10^{-4}(a_0 + a_1(x-18) + a_2(x-18)^2 + a_3(x-18^3)dx.$$

Substituting the values of constants and carrying out the integration $Q$ came out to be equal to 4.04 cusecs.

Applying the same method of analysis the losses that would occur in the power channel of Pathri Power House under construction to utilize a fall for 30 feet were calculated to be 8.55 cusecs.

## 28. Dewatering of Foundations at Pathri Power House

J. N. Mitra, K. P. Shukla and L. K. Mittal, Roorkee.

The foundation raft of the power house was to be laid 33 feet below spring level. So to make the excavations and other operations possible the foundations had to be dewatered in order to lower the spring level to that depth. For that purpose a system of tube wells which could pump up sufficient water to create the desired depression in water table were installed. Their minimum number and optimum distribution in the 155 feet long and 77 feet wide power pit, consistent with a maximum permissible size of strainer were determined in the laboratory.

The explorations and preliminary mathematical analysis indicated that 20 numbers 40 feet deep wells with 25 feet long and 6 inches diameter strainers yielding a discharge of 2.70 cubic feet per second could dewater the foundations and keep the spring level lowered to the desired depth. The actual distribution of these wells and their effective discharge were found out by electrical analogy models.

A model to the scale of 1"=20' was made, the raft was represented by a sheet of wood coated with paraffin and silver wires of desired length and thickness projecdte down, this piece represented tube wells. This model was floated in water contained in a circular copper drum which had insulated bottom. The wires joined together on the upper side were connected through a 12 volt battery and an ammeter to the container and total current obtained from a particular arrangement of wells was measured. In the next set of experiments the effective reduction of potential throughout the area was found out. For that purpose current was supplied through A.C. main through an oscillator and amplifior to the wire potentiometer connected in parallel to the model just as to form a wheatstone bridge. A probe moving in the model was connected through a head phone to the jocky on the potentiometer. The probe was fixed at different points and potential at the point determined by null method.

After a number of trials it is found that only 18 wells 40 feet deep with 25 feet long and 6 inches diameter strainers could be profitably distributed in the area. They were stagged. The percentage potential reduction which should not be less than 70% was found to be so with these wells. The total discharge was calculated from the formula: $Q = H\ C_1 q / C_2\ xd$

Where :- $Q$ = total discharge,
$q$ = pumping capacity of single well,
$C_1$ = total current,
$C_2$ = current from single well,
and $d$ = depression head for single well.

It gave a value of 2.83 cusecs.

This arrangement as recommended was adopted in the field and worked well in as much as prediction from model were exactly borne out by the results observed in the field.

## 29. Consolidation Characteristics of Typical Bundelkhand Soils Part II

K. P. Shukla, Roorkee.

In continuation to the investigations carried out before (Proc. Indian Science Congress 1951 p. 245) the physical properties, in general, and consolidation characteristics in particular of four types of soils popularly known as Mar, Kabar, Parwa and Rankar found in Bundelkhand region of Uttar Pradesh were studied. These soils especially those of first two groups are most unsuited for foundation purposes and to investigate ways and means of improving their bearing power that these investigations were carried out.

Soils were made to possess indentical mechanical composition by mixing suitable porportions of materials sieved out from different sieves. Properties of these samples were studied with reference to exchangeable ions and electro-chemical treatment.

These were saturated with mono-di and trivalent ions and homoionic soils thus prepared were subjected to Atterberg's Limits, Permeability and Consoilidation tests and results compared.

These homoionic soils were further treated with electric current and tested before and after treatment. They were also analysed chemically. It was found that adverse physical properties of Mar and Kabar can be improved enormously by saturating them with trivalent Aluminium ion. Similar improvement is effected by passing direct current in the soil enclosed between Al as anode and Cu as cathode. These processes can either be combined or applied separately.

Further experiments to adapt these methods to field conditions are in progress.

## 30. Model Studies in the Design of Earth-dams:Determination of Seepage Losses in open Channels & in Solving Ground-Water Problems Part-I Hydraulic Models

K. P. SHUKLA, Roorkee.

In recent years designs of various earth structures have successfully been attempted by extensive model studies, made in Soils Laboratory, Irrigation Research Institute, Uttar Pradesh. The technique of experimentation involving the selection of methods and materials peculiar to the nature of problem in hand, applicability of laws of semilitude, interpretation of model results and their verification by field results and those obtained by mathematical analysis whereever possible, was evolved and standardized. These methods were applied to basic research in the design of earth-dams and various types of tubewells, determination of seepage losses in channels, design of floors of impermeable structures on permeable foundations, dewatering of foundations and other like problems.

The basic research on earth-dams revealed that

(i) The phreatic line or the top most flow line depends on the boundaries of the dam and hydraulic head and the permeability of the material have no effect on the shape.

(ii) Increasing different elements of the profile namely (a) downstream slope, (b) upstream slope, (c) top width has the effects depressing the phreatic line in the above order.

The phreatic line in dams on impervious base always cuts the downstream slope, howsoever flat they are. To safeguard against piping, therefore a gravel toe has invariably to be constructed. A relation between its height "*h*", hydraulic head "*H*" and the slope of D.S. has been worked out.

(iii) The effciency of partial cutoffs for the prevention of seepage and failure of dams on pervious foundation has been studied. Curves for their different depth and lengths and their efficiency with regard to reduction of seepage have been drawn.

A number of specific problems, for the designs of different dams constructed in Bundelkhand, like Saprar, Lalitpur, Kabrai, Nagwa, Rangawan, Arjun, Sirsi, Ahraura and others have been tackled and the designs have been successfully evolved, Model tests on the types of tubewells on cavity, gravel shrouded and radials have been carried out and number of design problems have been solved. The radial well for instance consists of central sump at the periphery of which at particular depth number of perforated pipes known as radials are fixed. The water is drawn from the sump and is collected by radials. The experiments have among other things, revealed that the drawdown in these cases occurs in two directions one perpendicular to radials and the other along them. Also, relations between size of radials, their position, number and distribution have been worked out.

Basic Research in canal losses directed with different aims like the effect size, hydraulic mean depth on losses, effect or shape and depth of sub-soil water level on losses, investigations on canal linings and others have been carried out.

Finally, the dewatering of areas effecting the lowering of subsoil water level to facilitate the deep excavations, by system of tubewells, the design of floors of impermeable structures on pervious foundation with regard to uplift and exit gradient and infiltration of canal water in wells under the effect of piping water from them, have been successfully solved by the models.

## 31. Recovery of Iron Pyrite from Vindhya Pradesh Coal

S. Ranga Raja Rao, K. C. Lahiri *and* A. Lahiri, Manbhum.

The shortage of sulphur is acute in India; many schemes for recovery of sulphur from inferior raw materials are being examined. Coal-pyrites is one of them. Among the three forms of sulphur in coal, viz. organic, sulphate and pyritic, the pyritic sulphur in some cases exceeds 1% (as iron pyrite nearly 2%); and where circumstances are favourable, can be recovered.

In the course of a physical and chemical survey of the Madhya Pradesh coals of India, it was found that the top and bottom seam coal of Nowrazabad colliery (Vindhya Pradesh) contained high quantities of pyritic sulphur (1 to 1.3%). Float and sink analysis showed that practically 80% of pyritic sulphur went with the 'rejects' at 1.58 sp. gr. With the Nowrazabad top seam, the rejects at 1.58 sp. gr. amounted to 22% of the overall coal with 4% pyritic sulphur. From washability studies of top seam it was concluded that, theoretically, nearly 50 tons of iron pyrites could be recovered by 'washing' the above coal at 150 tons per hour (20 hrs. in a day).

Due to various reasons, carbon content in iron pyrites from coal should be low (5 to 6% only) for use in sulphuric acid manufacture. However, the recently devised fluo-solid roasters can tolerate higher percentages of carbon in iron pyrites.

Due to the fine dissemination of pyrites in the Nowrazabad coal as revealed by microscopic examination and X-ray radiograph, selective froth flotation technique was resorted to for concentration of the pyrites from the 'rejects' at 1.58 sp. gr. The froth flotation technique was not successful due probably to the high fusain content and the low rank of coal. Employing concentrating tables, the iron pyrites could be economically recovered from the washery 'rejects'. Results of a number of experiments suggested crushing of the washery rejects at sp. gr. 1.60 below 14 mesh B.S. and tabling. The once-tabled products should be recrushed below 25 mesh B.S. before re-treatment. By this method, a concentrate with 41.5 % pyritic sulphur and 8.67% carbon could be obtained. This means a recovery of over 62% pyrites present in the washery rejects and over 51% of pyrites present in the raw coal. On this basis, washing of Nowrazabad bottom seam coal at the rate of 150 tons per hour for 20 hours a day will result in 48.6 tons of pyrite 'concentrate' with 42% pyritic sulphur and less than 9% carbon. The cost of recovery is low. The recovery on commercial scale which is being contemplated by Messrs. Associated Cement Co., Ld., Bombay, will make a substantial contribution towards meeting sulphur shortage in India.

## 32. A Flowsheet of a Pilot Plant for the Recovery of Sulphur From Pyrites Deposits in Shahabad (Bihar)

S. Prasad, Patna.

Description of A flowsheet of a pilot plant for sulphur recovery from pyrites is given. The design is based on distillation of the labile Sulphur by heating pyrites at about 700°C. The remaining (combined Sulphur is removed in the form of $H_2S$ and $SO_2$ gases produced in equivalent proportion by the action of Coke and air-steam mixture. The two gaseous compounds are finally converted into elementary sulphur in presence of high iron activated bauxite.

An important feature in the design is the use of rotary retorts forheating pyrites. This helps in better recovery of Sulphur and low consumption of fuel. The Fuel Pyrites ratio is 0.273. About 98 per cent of sulphur is recovered.

A flow sheet of the plant together with heat balance and material balance of the process is given.

## 33. On the Mechanism of Depression of Pyrite.

K. K. MAJUMDAR, Dhanbad.

A new theory on the mechanism of depression of pyrite by alkali cyanide in the presence of ethyl xanthate as collector has been recently proposed by the author in which he attributed the depression of mineral to the reduction of ferric ions on the pyrite surface to ferrous ions, by CN , a condition which is unsuitable for the formation of water-repellant surface coatings of insoluble ferric xanthate, which is a prerequisite to successful flotation. In the present paper more instances have been brought forward to show that pyrite is depressed by reducing agents like sulphite ions, ferrous sulphate, and sulphur-di-oxide. These evidences are expected to support the theory mentioned above.

## 34. Beneficiation of low Grade Manganese Ores from Madhya Pradesh

V. S. PRADHAN, New Delhi *and* P. I. A. NARAYANAN, Jamshedpur.

(A) Low grade manganese ore sample from Kachidhana mines, M.P., assaying 41.6% Mn, 14.6% SiO , 8.46% Fe and 0.2% P, was enriched by gravity concentration and flostaiton methods to ferro-manganese grade. The ore consisted of braunite, psilomelane, pyrolusite, garnet, jaspery silica and some amount of schistose material. Jigging followed by tabling resulted in a product assaying 48.9% Mn with a recovery of 82.8%. Flotation of the ore using American cynamid reagent 708 produced concentrates assaying 47.07% Mn with a recovery of 74.23%. Roasting of the above concentrate at about 900°C. raised their manganese contents to over 51%.

(B) Low grade Tirodi mine dumps containing braunite, psilomelane, quartzite, garnet, micaceous schist, limonite, rhodonite and orthoclase assayed 27.39% Mn, 33.4% $SiO_2$, 7.47% Fe and 0.36% P. Jigging combined with magnetic separation yielded concentrates assaying 40% Mn with a recovery of 73% while straight magnetic separation recovered 61% manganese in a concentrate of grade 41% Mn. Flotation of the ore using oleic acid as the collector produced concentrates assaying 37% Mn with a recovery of 55%. Roasting raising the manganese content of the gravity-magnetic concentrates to 43.5%.

Investigation on sample *B* has shown that presence of appreciable amount of manganese garnet limits the degree of beneficiation by gravity methods.

## 35. Theoretical study of the Flotation Behaviour of Titanium Minerals

V. S. PRADHAN, New Delhi.

Flotation of synthetic rutile and natural rutile, brookite and ilmenite in sodium oleate solution is attributed to the adsorption of undissociated oleic acid on the surface of the minerals. Case against the ionic absorption is presented from the contact angle values on titanium minerals in dilute oleate solutions.

## 36. Influence of Gases on Contact angle of Minerals

K. K. MAJUMDAR, Dhanbad.

Recently Venkatadas & Rao pointed out that contact angle of minerals in some cases is a function of the nature of gas also and as examples they pointed out that carbonate minerals like calcite, witherite, strontianite, siderite and cerrusite, when conditioned in sodium oleate and sodium carbonate solution, gave lower contact angles with air, which may be even zero, and with carbon dioxide they give higher contact angles, the difference being in the range from 40° to 90°, but definite in each case. It is suggested that in those cases, the depressant action of carbonate ions derived from sodium carbonate has been overlooked, which was responsible for low contact angles with air. In presence of carbon dioxide, carbonate ions were converted into bicarbonate ions, which are harmless; hence the contact angle increased. In the case of calcite, the author found the same contact angle of calcite treated with sodium oleate in air, which has been reported by Venkatadas & Rao as that due to carbon dioxide.

## 37. Gravity Methods of Concentration and Their Application to Important Indian Minerals.

P. I. A. NARAYANA *and* G. V. SUBRAMANYAM, Jamshedpur.

The paper deals with the various gravity methods of concentration in use, the scope and limitations of each of the methods, and their applicability to the treatment of Indian minerals and ores particularly manganese, chrome, gold, wolfram ores and coal. Though flotation finds increasing application to the concentration of metallic and non-metallic minerals, it has not replaced the old gravity methods to any great extent. Due to the high cost of grinding to the flotation size, gravity methods of concentration have their own advantages and hold the field in the coarse size range. The sink and float method employing finely ground solids in suspension in water is now being largely used in the size range 3 in. × ⅜ in. for concentration of coal as well as metallic and non-metallic minerals.

It is hoped that with more and more information being made available about the amenability of the various low grade ores in India to ore-dressing methods of concentration, milling plants for manganese, chrome ores, coal, etc., will soon be installed, with a view to utilise our low grade deposits and conserve the country's mineral wealth.

# *40th INDIAN SCIENCE CONGRESS. LUCKNOW, 1953*

## PHYSIOLOGY

### *Abstracts.*

### 1. Seasonal Changes in the Thyroid and the Testis of Buffalo.

D. S. Bhatnagar and P. Bhattacharya, Izatnagar.

The thyroid and the testicular materials from 32 adult buffalo bulls slaughtered at the peaks of four different seasons viz., summer, autumn, winter and spring were studied. The thyroid materials were studied for seasonal variation in the diameter of the thyroid lobule and the height of the epithelial cells of the lobule and the testicular materials for histology and the diameter of the tubules. The study revealed the following:—

High air temperature with low relative humidity as obtainable in summer increases the diameter of the thyroid lobule and decreases the height of the epithelial cells and the diameter of the testicular tubule than in winter and spring. High air temperature associated with high relative humidity as found in autumn decreases the diameter of the thyroid lobule, the height of the epithelial cells and the diameter of the testicular tubule than in other seasons. Relative humidity is comparatively a more important factor than air temperature in controlling the diameter of the thyroid lobules; whereas for the height of the epithelial cells and the diameter of the testicular tubule both are equally important. Thyroid activity has been found to have indirect effect on the testicular activity. Height of the epithelial cells has been found to be more sensitive to changes in air temperature and relative humidity than the diameters of the thyroid lobules or the testicular tubules. Between the two glands the diameter of the testicular tubules has been found to be more sensitive to atmospheric changes than that of the thyroid lobule.

### 2. Time and speech-structure.

C. R. Sankaran and P. C. Ganeshsundaram, Lucknow.

The problem of *time* is approached from the study of Speech-structure. Duration is *sui generis.* Time can not be assimilated to Cantor-Dedekind type of continuity.

'Veronesean continuum' is used as a mathematical symbolism for constructing a 'geochronometry' in the wake of modern attempts to construct a 'quantised space-time'. The analogy with non-commutable operators 'n Quantum theory is applied straightway to consonant-vowel or vowel-consonant configuration and a function non-linear with time of non-Archimedean order is envisaged as the common (nuclear ?) matrix whence field equations descriptive of entire speech-structure can be derived.

A theoretically devised experiment invelving acoustical stimulus and cochlear response from the points of view of both neurophysiology and Information Theory is outlined in brief.

### 3. Effect of Progressive Experimental Aortic Coarctation on the left ventricular pressure pulses in dogs.

T. C. Gupta, Darbhanga.

An analysis of the left ventricular pressure curves show progressive increase in the amplitude of the curves and in the steepness of the gradient of the pressure rise and fall with progressive coarctation. The peak appears later and later in systole. The rounded and arch-shaped summit in the normal pressure curve is replaced by a more peaked summit. The duration of the curve is prolonged. In agreement with de Heer but opposed to Katz, Ralli and Cheer and Wiggers and Katz initial tension did not increase in milder degrees of stenosis and only slightly with severe degrees of stenosis. The increased rise of pressure maximum in the ventricle without a corresponding rise in initial tension is probably due to the heart acting more forcefully under a greater output load.

### 4. 'Gastric Response, Digestion and Evacuation time of Eggs and their preperations.'

Dr. J. D. Pathak and Shri M. L. Pai.

Four healthy medical students selected after gastric analysis and flouroscopic examination of the stomach were given eggs or its preparations in varying amounts once a week in the morning and samples of stomach content withdrawn from time to time and their gastric response regarding free and total acids, chlorides, digestive changes in the food and its evacuation time noted.

The following preparations were tested:—

(1) Raw egg (one), (2) Raw eggs (three), (3) Raw eggs (five), (4) Hard boiled eggs (one), (5) Hard boiled eggs (three), (6) Two eggs fried in ghee, (7) Three eggs taken in 100 c.c. milk.

Free and total acidity with any form of egg was higher than obtained on alcohol meal. The average highest free acidity in these preparations was 60 and that for total acidity was 85 c.c. of N/10 acid. Raw egg produced slightly more acid than other preparations. More eggs evoked more acid secretion and stayed longer in the stomach.

The chloride graphs resemble the acid graphs. The evacuation was delayed as the amount of eggs was increased.

*BOILED EGGS.*

One raw egg evacuated the stomach in 2 hrs. 48 mts. Three eggs in 4½ hours, and five eggs were not evacuated upto 5 hours. Boiled eggs took longer time. One boiled egg took 2 hrs. 55 mts., three boiled eggs 4 hrs. 35 mts. Two fried eggs took 4 hrs. 50 mts., three eggs shaken in 100 c.c. of milk evacuated in five hours and fifteen minutes.

A comparison is made with the work done by other observers.

### 5. Electrocardiograph studies in normal buffalo.

D. N. Mullick and N. D. Kehar, Izatnagar.

Electrocardiograph is used extensively by the clinicians to record different electrical stimulations during cardiac cycle in human beings. Considering its important application in health and disease in man, an investigation was undertaken to establish normal values for domestic animals. This article is the first of this series where an attempt has been made to establish values for normal buffaloes.

40 buffaloes of different ages from 5 to 10 years were used as experimental animals. The adult animals were in different stages of lactation and gestation.

The apparatus was a portable Cambridge instrument type. The procedure of recording was similar to that followed in the case of human beings.

The heart rates per minute as recorded in this instrument were 65, 38, 43 and 33 for the age groups within 6, 12, 24 and above 24 months respectively.

The durations of PR, QRS and QT intervals changed with the age.

The potential of different waves are indirectly proportional with the advance of life.

The waves are quite different from man and may be specific for the species.

### 6. The copper requirement of sheep.

N. D. Kehar and V. N. Murty, Izatnagar.

The requirement of copper for adult sheep has been evaluated from a statistical treatment of the data on twenty four balance studies. The daily intake of copper varied from 4.22 to 9.87 mg., and the retention from —0.6 to +2.48 mg., the average daily intake and retention being 6.03 ±0.41 and 0.88 ±0.20 mg. respectively.

The relation between intake and retention of copper is highly significant, the correlation coefficient being 0.954. This relation could be expressed in the form of an equation

$Y=0.4019\ X-1.5460$, with a standard error of ±0.81.

where X and Y represent the intake and retention of copper in milligrams. The regression equation was found to be highly significant.

The minimum requirement of copper, according to the Statistical method is 3.85 mg. per sheep per day, which in terms of dry matter intake works out at 7.0 parts per million parts.

### 7. Manganese requirement of sheep.

N. D. Kehar and V. N. Murty, Izatnagar.

The data on the intake and retention of manganese on twenty four adult sheep have been analysed statistically for evaluating the minimum requirement of manganese for sheep. The average intake of all the animals in 48.03 mg. per day within a range of 28.5 to 81.7 mg. The daily retention varied from —4.0 to 13.1 mg. and averaged 2.82 ± 0.90 mg.

The positive relation between the intake and retention of manganese was highly significant, the correlation coefficient being 0.753 for 22 degrees of freedom. The relation could be expressed by the regression equation:

$Y=0.1834\ X-5.9920$, with a standard error of ±2.89.

where X, is the intake, and Y, the retention of manganese in milligrams per day.

The equation was found to be highly significant.

From this the minimum requirement of manganese for adult sheep has been calculated to be 32.67 mg. per day or 59.0 parts per million parts of dry matter intake.

### 8. Seasonal variations in the activity of the endocrine glands.

D. N. Mullick and N. D. Kehar, Izatnagar.

Recent observation reported in this laboratory showed that the maintenance of normal health and production performance of an animal is not only dependent on the supply of adequate amount of nutrients, heredity and management but also on environmental factors like air, temperature and humidity etc. Also it was shown that adult rats secrete less thyroxine in summer months than winter.

Considering the close relationship with thyroid and other endocrine glands, the present investigation was undertaken to study the seasonal rhythm in the activity of the thyroid in relation to pituitary, adrenals and testis of rats.

Eight rats about 180 days old were sacrificed bi-monthly for one year. The thyroid, adrenals, pituitary and testis were removed in tact and weighed in a micro balance. The mean air temperature and the weights of the glands calculated per 100 gm. of the body weight of the animals are shown graphically. It was found that all the glands have negative correlation with the increase in air temperature. The percentage decrease in the activity of thyroid, pituitary, adrenals and testis was 49.6, 25.8, 22.6 and 23.6 respectively in summer as compared to winter. It was also noted that the highest correlation had been obtained in the case of thyroid. From this observation, it may be concluded that like thyroid, all the other endocrines also undergo seasonal cycles of activity, showing maximum in winter and minimum in summer months.

### 9. Seasonal variations in the activity of thyroid gland.

D. N. Mullick, Izatnagar.

Since thyroid activity is closely associated with heat production and other metabolic activities of the organism, an investigation was undertaken to study the seasonal rhythm in the thyroid hormone secretion rate in rats.

48 male rats were taken as experimental animals and divided into six groups. One group on normal diet served as control and the other five groups received the stock diet along with 0.1% thiouracil. These five experimental groups were also simultaneously injected with 4-8 $\mu$ gm. of thyroxine in winter and 3-7 $\mu$ gm. suring the other parts of the year. Body weights were recorded daily and the quantity of thyroid solution to be injected was calculated on the basis of the body weight. After 15 days the animals were killed and thyroid was removed quantitatively and weighed in a precision balance. This was repeated bi-monthly.

It was observed that the activity of the thyroid as indicated by the extent of secretion was influenced by weather conditions and are as follows: 7.5, 4.8, 5.00 and 5.0 microgram per 100 gm. of body weight in winter, summer, spring and autumn respectively.

These observations show a close inverse relation between the atmospheric temperature and thyroxine secretion rate.

### 10. Studies on the effect of germination on the phosphorus values of some common Indian pulses.

Bhavani Belavady and Sachchidananda Banerjee, Calcutta.

The phytin content and inorganic phosphorus content of eight varieties of pulses have been estimanted. Phytase and phosphatase activity of the pulses have been determined. It is observed that during germination phytin phosphorus values diminish and inorganic phosphorus values increase. Phytase activity which is absent in ungerminated pulse appears in germinated pulse. Phosphatase activity of pulses is increased during germination. Diminished phytin content of germinated pulses indicate the superiority of germinated pulse over ungerminated pulse with regard to the presence of the available phosphorus in the pulse.

### 11. Effect of storage on the stability of Vitamin A and carotene in blood serum.

P. N. Sen Gupta, Calcutta.

For assessment of human nutriture, blood serum samples are preserved in deep freeze prior to analyses for various nutrients. The stability of vitamin A and carotene in serum were investigated by preserving the serum samples in parafilm capped tubes and partial vacuum sealed tubes at -15 to -20°C (deep freeze), 2 to 5°C (refrigerator temperature) and 25 to 30°C (controlled room temperature). The samples were analysed at the end of 15, 30, 45 and 60 days according to the microchemical methods of Bessey and Lowry. The loss of carotene at the end of 60 days in parafilm capped and vacuum sealed tubes were respectively 4.6% and 1.7% at -20°C; 7.0% and 2.7% at 2—5°C and 12.9% and 7.3% at 25-30°C. Similarly the loss of vitamin A at the end of 60 days in parafilm capped and vacuum sealed tubes were respectively 15.7% and 8.8% at -20°C; 15.8% and 9.6% at 2-5°C and 44.7% and 37.8%. The loss of vitamin A was more pronounced than that of carotene and the latter preserved well at the refrigerator temperature in sealed tubes.

### 12. II—Normal blood Cholesterol level in Orissa.

J. M. Senapati and K. Subrahmanyam, Cuttack.

The total whole blood cholesterol was determined in forty normal individuals, by the method of Reinhold and Sheils modification of Myers Wardell technique. The values were:

| Name of worker | Total whole blood cholesterol | Range |
|---|---|---|
| Gorham and Myers | 160 mg | |
| Gradowhl | 210 mg | |
| Hawk | .. | 110-390 mg |
| Orissa | 176.6 mg | 116.1-252.4 mg |

In another 40 samples of blood of normal individuals, determination was made by the method of Schoenheimer and Sperry as modified by Hawk, of (i) total cholesterol; (ii) free cholesterol and (iii) esterified cholesterol (by difference). The values were:

| | Orissa | | Literature |
|---|---|---|---|
| | Mean | Range | |
| Total cholesterol | 178.9 | 116.2-215.2 | None in literature. |
| Free cholesterol | 108.8 | 50.4-160.2 | |
| Esterified ch. | 70.1 | 49.8- 87.8 | |

As the cholesterol values in cells remain unchanged in disease, it is more important to find out the cholesterol fractions in plasma in normal individuals. Work is in progress in that line.

### 13. Response of serum carotene and Vitamin A to variations in levels of dietary carotenoids.*

P. N. Sen Gupta, Calcutta.

With the objective whether carotenoids alone when ingested with the meals could maintain the normal levels of blood serum carotene and vitamin A, diets containing varying amounts of carotenoids and practically free from vitamin A were injected and vitamin A and carotene values of the serum were determined daily by the micro-chemical methods of Bessey and Lowry. 2500 I.U. as vitamin A was ingested for 10 days and during this period carotene and vitamin A values of serum depleted respectively from 404.8$\gamma$ and 65.5$\gamma$/100 c.c. to 287.3$\gamma$ and 43.2$\gamma$/100 c.c. These levels increased to 342.2$\gamma$ and 52.9$\gamma$/100 c.c. by the intake of 5000 I.U. for next 8 days. These rises continued and stabilised in the regions of 355$\gamma$ and 50$\gamma$/100 c.c. respectively when the experiment continued upto 25th day but the levels never returned to the original values. Ingestion of 20,000 I.U. on the eighteenth day only appeared to have no appreciable effect. The levels again rose to the normal values when the normal diets were restored for a fortnight after the experiment.

* The investigation was carried out at the School of Nutrition, Cornell University, Ithaca, N.Y., U.S.A.

### 14. The Carbon Dioxide combining capacity (Alkali Reserve) of Plasma of healthy individuals in Orissa.

J. M. Senapati, K. Subrahmanyam and S. M. Banerji, Cuttack.

Carbon dioxide combining capacity (alkali reserve) of plasma of 23 cases, all medical students between ages 20—30 and apparently healthy, has been determined. It is 34.7 vol to 48.6 vol % with an arithmatical mean of 42.9 vol %. These values are lower than average values given in literature.

### 15. A study on the Coagulation time and Prothrombine time of blood.

Dr. M. L. Chakrabarty, Calcutta.

Thrombosis has of late become a fairly common ailment producing in man disability at times of every serious nature. With the object of lessening the severiety of the attack by checking or retarding the progress of the intravascular clotting a physician prescribes dicoumarol or heparin. To carry on this treatment he generally requisitions the determination of coagulation time of blood and also the prothrombine time which apart from enabling him to decide the dose of the medicine helps him to form a prognosis as well. From the theoretical consideration there should be a parallalism between the results of the two examinations just mentioned but on actual experiments it is found otherwise in a good percentage of cases. The cause is not known.

An inquiry has been made in the paper for the cause of lack of parallalism and all the possibilities discussed in detail. It is considered that the vessel wall is primarily responsible.

## 16. Variations in the concentrations of serum Electolytes in diabetic acidosis and coma.

S. K. Vaish, Izatnagar.

In view of the fragmentary evidence available on the concentration of blood electrolytes in diabetic acidosis, a systematic study was undertaken to determine the P, K, CI, Na and Mg values.

For these experiments, dogs were selected as experimental animals. Since physiological values for the concentration of these electrolytes in blood and serum of dogs under Indian conditions are not available, the experimental study was preceded by the determination of normal values in 12 healthy dogs.

In order to find out if diabetic acidosis causes any variation in the electrolyte make up of blood, nine healthy dogs were selected. Three of them were kept as controls and the other six formed the experimental group. Artificial diabetes was produced in the experimental group of animals. Glucose tolerance test was performed both in control and experimental animals. The Bicarbonate concentration was found to be 0.687 ± 0.095 ml of 0.01 M $NaHC0_3$ per ml of plasma in the experimental animals compared to 1.127 ± 0.051 ml in control. The corresponding pH values for the experimental and control animals were found to be 7.46 ± 0.042 and 7.23 ± 0.061 respectively. Both inorganic phosphates and K were 4.02 ± .541 and 7.76 ± .653 mEq/lit respectively in the experimental animals as compared to 2.07 ± .15 and 5.15 ± .378 in the control group.

Observations analogus to the above were also carried out in dogs in which diabetic coma was produced experimentally. In diabetic coma the changes in the concentration of electrolytes in blood were more marked than in diabetic acidosis. Here again the bicarbonate concentration was found to be 1.16 ± 0.09 ml and 0.28 ± 0.08 ml of 0.01 M $NaHC0_3$ per ml of plasma in the control and experimental animals respectively. The corresponding values for the pH were 6.99 ± 0.078 and 7.44 ± 0.07 in the experimental and control animals respectively. Inorganic phosphorus and potassium were 6.72 ± .084 and 10.515 ± 1.412 mEq/lit respectively. The chloride concentration was 88.55±4.63 mEq/lit in the experimental animals as compared to 100.17 ± 4.598 in the control. Protein concentration was 18.23 ± .87 in the control as compared to 22.07 ± .97 mEq/lit in the experimental animals.

## 17. "Hydrolytic Enzymes in Sea Anemones".

P. N. Chaudhari and Kamala Sohonie, Bombay.

The Biological name for Sea-Anemone is 'Urtricina (Tealia) Crassicornis'. It's sketelonless structure and external character of expansion and contraction make the authors study its enzymes. The dessected body gives scope to study it separately in (1) Tentacles, (2) Muscles, (3) Gonads, and (4) Sticky-liquid. Sea-water, taken into the body during expansion does not show enzyme activity. Tentacles do not possess enzyme activity. The muscle extract as well as gonad extract shows peptic activity at pH 2, tryptic activity at pH 8 and catheptic activity at pH 6; where catheptic activity is abundant. Muscle extract also contains considerable amount of lipase and Amylase. Results are discussed.

Catheptic activity, being Papain type, offers the study with activators HCN acid $H_2S$ water. Sticky-liquid also shows the presence of proteolylic activity. Enzymes are destroyed by organic solvents, as well as in the process of drying. The attempts of purification of Enzymes by saturated $Am_2SO_4$ are quite encouraging. Purification and crystallization of enzymes are in progress.

### 18. Distribution of digestive Enzymes in liver-fluke (Fasciola Gigantica).

M. M. Goil, Bareilly.

The adult flukes feed on tissue elements in the liver but the work done on their digestive ferments is very scanty. In the present investigation, the method used by Palvovasky and Zarin in investigating the digestive enzymes of the liver of scorpions has been adopted. The glycerine extract of the flukes was prepared and Trypsin, Lipase and Pepsin were tested. It was found that Lipase was present and Pepsin and Trypsin had very slow action.

### 19. II. Development of rancidity and attendant changes in vegetable oils on storage.

S. M. Bose and V. Subrahmanyan, Mysore.

Samples of freshly extracted groundnut and coconut oils were stored in thin layers in open specimen tubes for twenty-six weeks under laboratory conditions (room temperature, 20°-34°C) and were analysed at regular intervals for acid value and peroxide number. The iodine and saponification values of the oils were determined before and after storage. The results showed that both the oils developed oxidative rancidity after practically the same period of storage, although the oils differed markedly in the degree of unsaturation. In each oil, the peroxide number was found to rise steadily and then to fall to some extent towards the end of the storage-period. In both the oils, the acid value was found to increase to some extent and the iodine and saponification values were found to decrease only slightly on storage.

### 20. Casein from deteriorated skim milk powder.

V. Subrahmanyan, M. V. Lakshminarayana Rao, M. Swaminathan and S. Kuppuswamy, Mysore.

A simple and relatively inexpensive procedure for the recovery of casein from skim milk powders, which, under storage, have undergone browning and other associated deteriorative changes resulting in loss of dispersibility, has been developed. It consists in leaching out the carbohydrates and other water-soluble constituents at pH 4.6, the isoelectric point of casein, by employing hydrochloric or sulphuric acid for the purpose. The yield is of the order of 30% of the milk powder.

The physical properties of the protein as also its biological value are determined by the extent of deterioration of the parent milk powder. The colour and solubility of the original milk powder could be correlated with the lowering in the free amino nitrogen of the casein and its biological value. The protein recovered from skim milk powders which have suffered extensive browning or bacterial, mold or insect spoilage, has very low nutritive value and is unfit for human consumption, but that reclaimed from milk powders rejected just on account of their poor reconstitution has a biological value only slightly lower than that of standard casein.

The recovered casein could be used for protein enrichment of hospital and other dietaries and in the preparation of sodium caseinate and composite protein foods. It makes a poor plywood adhesive.

### 21. The Proteolytic Enzymes of Germinated Ragi and Ragi Malt.

M. R. Chandrasekhara and M. Swaminathan, Mysore.

The proteolytic enzymes of ragi and ragi malt have been investigated. The optimum temperature and pH, for the activity of the enzymes have been studied. The ungerminated grain has a very little proteolytic activity. The enzyme activity develops on germination of the grain. Of the substrates studied namely casein, egg albumin and gelatine, casein appears to be the best. The enzyme is activated by hydrogen sulphide.

### 22. Vitamin A in liver in relation to Helminthiasis in Sheep.

N. D. Kehar, P. C. Sawhney and A. N. Bahl, Izatnagar.

In view of the importance of carotene in the nutrition of sheep and also the effect of worm infestation on its storage in the animal system under normal conditions of rural farming, a systematic study to find out the possible correlation between helminthic infestation and the carotene and vitamin A content of the liver of sheep was started which extended over a period of two years

The livers of one hundred and twelve animals slaughtered in the local abattoir were examined for vitamin A and carotene contents. Simultaneously, the faeces of animals whose livers were taken, were examined for worm ova count. It was observed that the maximum amounts of carotene and vitamin A was present from July to September. The livers were found to contain the maximum amount of 192.5 μ gm/gm. vitamin A and 3.375 μ gm/gm. carotene in the month of August, and the lowest values of 10.93 μgm/gm. vitamin A and 0.23 μgm/gm. carotene were observed during January, 1950.

An interesting observation has been that whereas the maximum storage of vitamin and carotene in the liver was noticed in the months of July, August and September, the worm burden was also maximum during these months.

### 23. Lipid Metabolis in Ruminants.

S. N. Ray, Izatnagar.

A method for the estimation of total lipids in ruminant faeces is described. The alcohol extract of the faeces is dried and the residue treated with chloroform. The dry matter content from the chloroform solution is taken to be the total lipid. This method gives much more consistent results between duplicate determinations and much higher lipid contents than those determined by the usual petroleum ether extraction method. The procedure of adapting the new method in digestion trials has been detailed. The implication of these findings on the digestibility of fat in ruminants and the starch equivalent value of feeds has been discussed.

### 24. Digestibility of fats.

S. N. Ray, Izatnagar.

Unlike protein metabolism, the excretion of fat in the faeces is not significantly related to the food intake. Of all the fat fractions of the diet, the excretion of the fatty acids in the faeces is increased most significantly when fat is added to a fat free diet. Neutral fat excretion on fatty diet is not increased over that on a fat free diet. A simplified procedure for determining the digestibility coefficient of fat through the estimation of fatty acid content of the faeces is described.

### 25. Physiological studies on the blood of domestic animals. Part VII—Sheep.

V. N. Murty, Izatnagar.

In view of the paucity of information on the normal blood picture of Indian sheep, a systematic study was undertaken to establish the normal physiological standards for the morphological, organic, and inorganic constituents of the blood of this species. The observations were made on thirty two adult healthy sheep. The range and average values with standard error are given below:—

Hb. (7.31—12.47) Av. 9.82±0.25 gms per 100 ml. blood.
R.B.C. (8.16—12.62) Av. 10.47±0.21 millions per c. mm/blood.
Cell volume (27.12—36.35) Av. 31.20±0.45 per cent.
M.C.V. (27.74—34.12) Av. 29.92±0.27 cubic, microns.
M.C.H. (8.21—10.84) Av. 9.35±0.10 micro microgrammes.
M.C.H.C. (26.13—36.28) Av. 31.35±0.46 per cent.
W.B.C. (7.2—11.4) Av. 9.20±0.18 thousands per cubic millimeter blood.
Sugar (40—68) Av. 54±1.47 mg. per 100 ml. blood.
Protein (4.84—8.24) Av. 6.69±0.15 gms per 100 ml. of serum.
Calcium (9.2—12.6) Av. 10.58±0.15 mg. per 100 ml. serum.
Magnesium (2.04—3.23) Av. 2.53±0.06 mg. per 100 ml. serum.
Inorganic phosphorus (3.88—6.62) Av. 5.13±0.15 mg. per 100 ml. blood.

### 26. Seasonal variations in grasses.

V. N. Murty, Izatnagar.

Seasonal variations in grass samples of Pennicitum cenchroids, Pennicitum purpureum (elephant grass), pennicitum purpureum (napier grass), Pannicum maxicum, Pannicum antidotum, chloris gayana, cynodon plectostachyum, Hetropogan contortus, and *banchari* have been studied in the four different seasons. The samples were analysed for iron, dry matter, crude protein, calcium, phosphorus and copper. The results were graphically represented and analysed statistically.

There are not only highly significant variations in the iron content of the different grasses, but the influence of seasonal changes is also [illegible] highly significant. Similar results were obtained with calcium and phosphorus. Inspite of the highly significant seasonal changes in the protein content of grasses, the different grasses showed no significant differences among themselves. There were significant differences in the copper content of the grasses studied, but the influence of season was insignificant. In general, the lowest concentration of protein and minerals, was observed in September. The maximum and minimum amounts of iron in grasses, in general, were noticed in December and September respectively.

In the majority of the grasses there existed an inverse relation of iron with copper and dry matter and a direct relation with other constituents.

### 27. Studies on miscellaneous crops.

V. N. Murty, Izatnagar.

The iron content as influenced by the progressive maturity and irrigation of linseed, mustard and turnips was studied at monthly intervals from the date of sowing till they were dead ripe. Simultaneously the dry matter, crude protein, calcium, phosphorus, copper and ascorbic acid were also studied.

The results showed that the iron content of the above three crops decreased with the growth of the plants. The dry matter increased, while the crude protein, phosphorus and ascorbic acid decreased with the growth of the crops, and the variations were highly significant except for ascorbic acid in mustard, which was significant. The variations in calcium content were significant only in the case of turnips.

The results were analysed statistically. There was a significant increase in the iron content of linseed.

The relation of each of the constituents with the rest has been evaluated statistically.

### 28. Studies on leguminous crops.

V. N. Murty, Izatnagar.

The influence of progressive growth and irrigation, on iron, dry matter, crude protein, calcium, phosphorus, copper and ascorbic acid, in five leguminous crops—lucerne, berseem, pea, gram and masoor—and the statistical relation of each of the constituents with others have been reported in this article.

The samples from irrigated and non-irrigated crops were collected at monthly intervals from the date of sowing till they were dead ripe, except lucerne which was collected for six months. Berseem could not thrive without water.

Berseem from the first month, gram and masoor from second month, showed a steady fall in their iron content, whereas pea from the second month and lucerne from third month recorded a rise with the progressive growth of the crops.

The results of the statistical analysis have been given. With the progressive maturity of the crops, all the constituents except dry matter, decreased, with irregular trends in few cases. With the maturity of the crops there is a significant change in the iron content of the crops. The effect of irrigation on the iron content was found to be significant in pea, gram and lucerne.

### 29. Physiological studies on the blood of domestic animals. Part VIII. The normal distribution of iron in the blood of ruminants.

V. N. Murty, Izatnagar.

Since iron plays an important part in erythropoiesis, observations on the normal distribution of the three fractions of iron, viz., blood iron, easily split-off blood iron, and serum iron, were made on 32 sheep, 24 Kumauni cattle, and 6 buffaloes.

The average amount of blood iron was found to be 36.05±0.94 (27.02—46.12 )mg. in sheep, 36.74±1.06 (28.37—48.78) in Kumauni cattle, and 41.54±2.11 (34.26—48.48) mg. in buffaloes.

The easily split-off blood iron in sheep varied between 1.70 and 3.05 mg. with an average value of 2.21±0.06 mg. per 100 ml. blood, whereas it averaged 2.22±0.05 mg. with a range of 1.86 to 2.68 mg. in Kumauni cattle, and 2.44±0.23 mg. with a range of 2.04 to 2.74 mg. in buffaloes.

The mean serum iron concentration was 145.5±3.40 (114—184) mg. in sheep, 132.4±3.93 (102—172) mg. in Kumauni cattle, and 149.2±7.96 (124—172) mg. per 100 ml. of serum in buffaloes.

### 30. Investigation on the nutritive value of tree leaves—Phaldu (Mitragyna Parvifolia) leaves as feed for cattle.

B. C. Joshi, M. M. Jayal and K. Sahai, Izatnagar.

It is a large deciduous tree growing to a height of 40-50 feet in the sub-mountain tracts of the Himalayas and found in Tarai regions of Uttar Pradesh. On chemical analysis the leaves were found to contain crude protein 7.73, ether extract 3.27, crude fibre 19.57, nitrogen free extract 60.65, total carbohydrates 80.22, total ash 8.78, calcium (CaO) 3.17 and phosphorus ($P_2O_5$) 0.56. Feeding experiments with kumauni bullocks indicated that the leaves were not much relished, resulting in poor consumption.

To meet the dry matter and digestible crude protein requirement the feeding of the leaves was supplemented with wheat bhoosa and rape cake.

The digestible crude protein, total digestible nutrients and starch equivalent per 100 lbs. on dry basis were 1.47, 50.0, and 38.56 respectively.

The animals exhibited on an average positive balances for nitrogen and calcium but negative balance for phosphorus. The observations tend to show that Phaldu leaves cannot be fed as a single feed to cattle.

### 31. The absorption of fatty acids from the Rumen.

A. T. Phillipson, Scotland.

Recent research in the Physiology Department of the Rowett Research Institute confirms the fact that short chain fatty acids are absorbed from the rumen of the sheep. The mixture of acids entering the blood, however, is not representative of the mixture of acids found in the rumen, and this is due to the partial metabolism of certain acids by the rumen epithelium. At least one-half of the portion of butyric acid metabolised by the rumen epithelium is converted to ketone bodies. Losses of propionic acid were found *in vitro* and the losses were increased by the presence of carbon dioxide.

Under certain circumstances chloride can be absorbed from the rumen against the concentration gradient. The facts regarding sodium are conflicting, but the same may be true for this ion. Potassium, always present in high concentration in the rumen, is absorbed from that organ although phosphorus in an inorganic form penetrates the rumen epithelium in only minute amounts in spite of the fact that its concentration inside the organ is at least 10 times that of blood.

The composition of the inorganic medium in which fatty acids are incorporated has some influence on the rate at which these acids are lost from the rumen, thus the relative rates of disappearance of sodium acetate, propionate, or butyrate from simple aqueous solutions are altered if these salts are incorporated in a saline solution comparable to the inorganic constituents of the rumen contents which is continually gassed with carbon dioxide. The rumen epithelium must not be regarded as an inert membrane but as active tissue, and it appears that its activity influences the rates at which simple molecules and ions pass through it in either direction.

### 32. Adaptability and nutritive value of foreign grasses under the environmental conditions of Assam. 1. Panicum Antidotale.

B. K. Das, Assam.

Panicum Antidotale—an American grass was cultivated under the environmental ronditions of Assam with a view to study its nutritive value with special reference to calcium metabolism as most of the indigenous grasses of Assam were found to exhibit poor calcium assimilations.

Panicum Antidotale contains on dry basis 10.75, 2.34, 36.58, 0.37 and 0.36 per cent of crude protein, ether extract, crude fibre, calcium (Ca) and phosphorus (P) respectively. It is richer in the essential nutrients than many of the Assam's indigenous grasses investigated so far.

Its average dry matter consumption is 2.0 lbs. per 100 lbs. body-weight and evidently therefore it is palatable.

Average digestibility co-efficients of dry matter, crude protein, either extract, crude fibre, nitrogen-free extract and total carbohydrates are 62, 72, 34, 65, 62 and 64 respectively. The digestion of organic nutrients may therefore be considered good.

Digestible protein and starch equivalent per 100 lbs. of the green grass are 2.17 and 10.42 lbs. respectively. This shows that the grass is in no way inferior to most of the well-known cultivated fodder plants of India.

Unlike many of the Assam's indigenous grasses, positive assimilation of calcium is assured by the feeding of Panicum Antidotale. The nitrogen balance is also positive.

### 33. Utilization of fish by-products as cattle feed: III. Influence of the method of manufacture of manthal (Cynoglossus semifasciatus) fish meal on nutritive value andd efficiency of proteins.

S. S. Negi, Izatnagar.

In continuation of the work reported in the previous years, an investigation was undertaken to study the differences in the nutritive value of manthal fish meal processed in two different ways. The ad lib. wheat *bhoosa* ration in the two groups of animals was respectively supplemented by equivalent amounts of crude protein from the 'beach dried' and 'cooked and pressed' manthal meals.

The 'beach dried' meal was observed to be more palatable than the 'cooked and pressed' meal. The latter had also a depressing effect on the consumption of basal ration by the animals. The digestibilities of crude protein in the two meals were obtained as 68% and 84% respectively. Thus, though the two meals had similar protein contents, the D.C.P. contents in the two meals on dry basis were 48.93% and 59.98% respectively. Since crude protein is the main constituent in fish meals, the higher D.C.P. value of 'cooked and pressed' meal also raised its T.D.N. and S.E. values.

Though the proteins from the 'cooked and pressed' meal were absorded better from the alimentary tract, the absorbed nitrogen from the 'beach dried' meal had an efficiency to be retained better by the animals. The large excretion of nitrogen *via* the kidney by the animals on the 'cooked and pressed' meal indicated that 'cooking' may have an injurious effect on the protein complex of fish meals resulting in their easy post-absorptive deamination.

The animals on the 'beach dried' meal made excellent body gains but those on the 'cooked and pressed' meal only maintained weights.

### 34. Utilization of fish by products as cattle feed: IV. Digestibility and nutritive value of 'beach dried' white bait (Stolephorous tvi) meal.

S. S. Negi, Izatnagar.

In continuation of the earlier study on 'beach dried' manthal meal, investigation was undertaken to evaluate the digestibility and nutritive value of a beach dried' white bait fish meal.

Like the manthal meal, the white bait meal contained high contents of protein, lime and phosphate in well balanced proportions. However on the basis of crude protein content the white bait meal with a protein content of 76.98% was superior to manthal meal having only 71.95% of this constituent.

In the feeding experiment with Kumaoni bullocks, the usual roughage was supplemented by a calculated quantity of white bait meal, the level of crude protein from the meal per unit of body weight being the same as maintained in the experiment with 'beach dried' manthal meal.

The digestibility of crude protein in white bait meal was found to be 84% whereas it was as low as 68% in the manthal meal prepared by a similar process. Thus the D.C.P. content of white bait meal was 64.66% against 48.93% in manthal meal. But the nitrogen retention on manthal meal was higher than on the white bait meal indicating a more favourable amino acid make up of manthal proteins. However the D.C.P., S.E. and T.D.N. values in white bait meal were considerably higher than in manthal meal prepared by a common process.

The animals on white bait meal showed positive balances of minerals and maintained excellent health and general body condition.

The effect of feeding white bait meal on the blood composition of animals was of a nature almost similar to that produced by manthal meal, prepared in a similar manner.

## 85. Studies on tree leaves as fodder. Marorfali (Helicteres isora) leaves.

N. D. Kehar, M. M. Jayal and B. S. Gupta, Izatnagar.

Marorfali is a shrub with thin spreading branches. The shrub grows very luxuriently in the Dehradun, Ramnagar, Saharanpur and Haldwani forest divisions of Uttar Pradesh and is also found in Punjab and Bengal. The leaves along with the tender branches are extensively lopped by the migratory population of the Kumaun hills for feeding their cattle.

The percentage chemical composition of the green leaves (on dry basis) was found to be: crude protein 13.25, ether extract 3.04, crude fibre 19.8, nitrogen free extract 53.02, calcium (CaO) 3.15 and phosphorus ($P_2O_5$) 0.69.

To determine its nutritive value these leaves were fed *ad libitum* to six kumauni bullocks for a period of forty days. A gradual increase in the daily average consumption of these leaves was noticed. The average daily consumption of green leaves which was 17 lbs. per animal during the first week of feeding, rose to 25 to 27 lbs. by the end of the second week. At this stage the consumption of leaves became stabilised and remained stationary till the end of the experiment. On dry basis, the bullocks, on an average, consumed 2.53 lbs. of leaves per 100 lbs. of live weight, which is a fairly high figure and indicative of the high palatability of these leaves.

In the metabolic trial conducted on the kumauni bullocks the average percentage digestibilities of crude protein, ether txtract, crude fibre and nitrogen free extract were found to be 73.1, 22.5, 40.6 and 73.7 respectively. These figures, specially for crude protein and nitrogen free extract, are fairly high. The digestible crude protein, total digestible nutrients and starch equivalent values in lb. per 100 lbs. of the dry leaves, have been worked out to be 9.68, 58.32 and 46.03 respectively. The nutritive ratio 1:5 found in these leaves is quite narrow and nearly corresponds to that of gram and maize grain. This indicates that the leaves could replace the concentrate feeds.

The balance for nitrogen, calcium (CaO) and phosphorus ($P_2O_5$) were positive, which agrees with the average increase of 5.5 lb. in live weight, recorded by the animals at the end of the experiment.

It may be concluded from these observations that *Marorfali* leaves are highly palatable and quite rich in all the essential nutrients. The forest departments are being advised to consider the encouragement of its cultivation and control indiscriminate lopping as the shrub extends a promise of great usefulness ia providing a highly nutritious feed.

## 86. Studies on tree leaves as fodder. Khair (Acacia catechu) leaves.

M. L. Sardana and K. Sahai, Izatnagar.

Acacia catechu is a moderate sized tree with thorny branches. Catechin, a product of commercial value is extracted by boiling chips of its heart wood. It is distributed in Punjab, North West Himalaya, Central India, Bihar and Deccan.

The percentage chemical composition of green leaves on dry matter basis was found to be: crude protein 13.025, ether extract 4.55, crude fibre 22.55, nitrogen free extract 50.963, calcium (CaO) 3.843 and phosphorus ($P_2O_5$) 0.395.

Feeding experiment was conducted on six kumauni bullocks which were offered green leaves *ad-libitum* with only 4 ozs. of rape cake to meet the remaining protein requirements. The daily average consumption of these leaves was found to be 2.46 lbs. (dry basis) per 100 lbs. live weight. The average digestibility coefficients for crude protein, ether extract, crude fibre and nitrogen free extract were found to be 23.9, 60.2, 30.6 and 59.6 respectively.

Digestible crude protein, total digestible nutrients and starch equivalent values per 100 lbs. of the dry matter were calculated to be 2.90, 46.33 and 32.16 respectively. The bullocks maintained satisfactory healthy condition throughout the feeding period and, on an average recorded an increase of 4 lbs. in live weight at the end of the metabolic trial, which is in agreement with the positive nitrogen, calcium (CaO) and phosphorus ($P_2O_5$) balances displayed by the animals.

The above observations tend to prove that "Khair" leaves supplemented with a little quantity of rape cake, can form a maintenance ration for catttle.

### 37. Studies on tree leaves as fodder. Shisham (Dalbergia sissoo) leaves.

M. M. Jayal, Izatnagar.

The chemical composition of green Shisham leaves on dry matter basis was found to be: crude protein 16.20 per cent, ether extract 4.03 per cent, crude fibre 24.37 per cent, nitrogen free extract 46.19 per cent, calcium (CaO) 3.17 per cent, and phosphorus ($P_2O_5$) 0.48 per cent

When *Shisham* leaves were fed as the sole feed, it was observed that the bullocks did not relish these leaves, the dry matter consumption was low and the animals lost in weight.

To study its nutritive value the leaves were supplemented with wheat bhoosa and rape cake to make up for the dry matter and crude protein requirements of the bullocks and fed to six adult kumauni bullocks for thirty days. The digestion coefficients, on an average, for crude protein, ether extract, crude fibre and nitrogen free extract were found to be 56, 27, 30 and 72 respectively.

The digestible crude protein, total digestible nutrients and starch equivalent in lbs. per 100 lbs. of leaves, on dry basis, were found to be 9.07, 52.44 and 37.40 respectively. The animals maintained positive balances for calcium, phosphorus and a slightly negative balance for nitrogen.

The observations tend to indicate that Shisham leaves are not palatable enough to form a maintenance ration for Kumauni bullocks but in combination with rape cake and wheat bhoosa may be fed to animals under scarcity conditions.

### 38. Studies on tree leaves as fodder. IV. Neem (Azadirachta indica).

M. M. Jayal, Izatnagar.

It is a large well known tree in India and is being cultivated from remote times. It grows in tropical and temperate climates and the shoots are commonly used for cleaning teeth. The leaves, bark and roots of the tree are also of medicinal importance.

The leaves on analysis were found to contain 16.12 per cent crude protein 20.69 per cent crude fibre, 72.75 per cent total carbohydrates, 1.96 per cent CaO and 0.54 per cent $P_2O_5$.

On feeding the leaves to hill-bullocks it was observed that the consumption of leaves increased gradually to a maximum of 10 lb. but started following down again and became more or less stationery at about 4-6 lbs. per animal per day.

To study its nutritive value six hill bullocks almost similar in age body weight etc.. were selected. They were fed on 4 lb. of leaves plus wheat bhoosa and rape cake to meet their dry matter and protein requirements.

The digestible crude protein, total digestible nutrients and starch equivalent values per 100 lb. of dry matter were found to be 8.38, 53.55, and 40.38 respectively. The balances for nitrogen, calcium and phosphorus were positive.

During the course of experimental feeding, the animals maintained good health and showed an average increase of 11 lb. in the body weight. The results indicate that the leaves can form a satisfactory roughage which can be fed to a limited extent.

### 39. Studies on tree leaves as fodder. Bankli (Anogeissus latifolia) leaves.

M. L. Sardana and B. S. Gupta, Izatnagar.

Bankli is a large deciduous tree and is common in the Tarai belt of the Himalayas. Its leaves are lopped for fodder in times of scarcity.

In order to determine whether *Bankli* leaves could form a suitable roughage for cattle, observations were made on its palatability, chemical composition and nutritive value.

On chemical analysis the leaves were found to have the following percentage composition on dry basis : total ash 9.49, crude protein 7.45, ether extract 3.55, crude fibre 24.15, nitrogen free extract 55.36, calcium (CaO) 4.24 and phosphorus (P O ) 0.767.

The animals on an average could not consume more than 8 lbs. of the green leaves per head per day which could form only two third of the dry matter and digestible protein requirements.

In the metabolic trial conducted on the kumauni bullocks, the average percentage digestibilities of crude protein, ether extract, crude fibre and nitrogen free extract in *Bankli* leaves were found to be 7.65, 53.15, 31.53 and 63.90 respectively. The digestible crude protein, total digestible nutrients and starch equivalent values in lbs. per 100 lbs. of dry leaves were found to be 0.57, 47.78 and 33.13 respectively. The balances for nitrogen, calcium (CaO) and phosphorus ($P_2O$ ) were positive.

The above observations point out that *Bankli* leaves may be utilised as part roughage, for feeding cattle during periods of fodder shortage.

### 40. Studies on tree leaves as fodder. Kusum (Schleichera trijuga) leaves.

B. S. Gupta and K. Sahai, Izatnagar.

It is a large umbrageous tree and is distributed in the Sub-Himalayan tract from the Sutlej to Nepal, Chota Nagpur, Central India and the Penninsula generally. It is not found in Assam so far. In the Tarai and Bhaber regions of Uttar Pradesh these leaves are lopped for feeding cattle by the hill migrants during the winter months.

The percentage chemical composition of the green leaves, on dry matter basis, was found to be : crude protein 10.37, ether extract 1.93, crude fibre 32.34, nitrogen free extract 49.21, calcium (CaO) 2.42 and phosphorus ($P_2O_5$) 0.71.

To determine the nutritive value, *Kusum* leaves supplemented with rape cake and wheat bhoosa to make up the digestible protein and dry matter requirements, were fed to kumauni bullocks. The average percentage digestibilities of crude protein, ether extract, crude fibre and nitrogen free extract were found to be 33.1, 35.5, 30.6 and 67.9 respectively. The digestible crude protein, total digestible nutrients, and starch equivalent values in lb. per 100 lbs. of the dry leaves were found to be 3.4, 48.23, and 29.03 respectively. The animals recorded positive balances for nitrogen, calcium and phosphorus and maintained weight.

It appears from the above observations that *Kusum* leaves in combination with wheat bhoosa and rape cake could form a suitable ration for the bullocks and the leaves could, with advantage, be used as a substantial part of the roughage.

### 41. Studies on tree leaves as fodder. Gauj (Millettia auriculata) leaves.

M. M. Jayal and K. Sahai, Izatnagar.

Gauj is a large woody climber with downy branches and is found in the outer Himalayas from the Sutlej eastwards to Sikkim, upto 3500 feet. In Uttar Pradesh it grows in abundance in the Doon and the Saharanpur forests and is very common in Jaunsar and Tarai-Garhwal. The leaves and twigs are lopped for feeding cattle by the hill migrants.

Gauj leaves on analysis were found to contain 22.63% crude protein, 4.57% ether extract, 2.69% calcium (CaO) and 0.66% phosphorus ($P_2O_5$).

To study the palatability and the nutritive value, Gauj leaves were fed *ad-libitum* to kumauni bullocks for 63 days. The daily average consumption of the green leaves gradually rose and became stabilised in the neighbourhood of 23 to 25 lbs. after one month. On dry basis the bullocks, on an average, consumed 1.9 lbs. of leaves per 100 lbs. live weight.

In the metabolic trial conducted with the bullocks the average percentage digestibilities of crude protein, ether extract, crude fibre and nitrogen free extract were found to be 68.4, 35.5, 30.6, and 49.3 respectively. The digestible crude protein, total digestible nutrients and starch equivalent values have been worked out to be 15.51, 44.34 and 24.01 respectively. The digestible crude protein value could be favourably compared to that of the grains and seeds like cotton seed, gram and maize.

The bullocks maintained very healthy appearance and displayed positive balances for nitrogen, calcium (CaO) and phosphorus ($P_2O_5$).

It is evident from the above observations that these leaves by themselves could form a very satisfactory ration.

### 42. Studies on tree leaves as fodder. Khoda (Ehretia laevis) leaves.

B. S. Gupta and M. M. Jayal, Izatnagar.

It is a moderate sized deciduous tree with a spreading crown. In Uttar Pradesh it is common in Doon and Saharanpur forests.

The green leaves were found to have the following percentage chemical composition on dry basis : crude protein 13.50, ether extract 6.00, crude fibre 17.98, nitrogen free extract 51.17, calcium (CaO) 2.09 and phosphorus ($P_2O_5$) 0.62.

When leaves alone were fed to bullocks, the daily average of leaves consumption gradually increased to 8-9 lbs. at which stage it became stabilised. The remaining digestible crude protein and dry matter requirements of the bullocks were made up by supplementing leaves with the requisite quantity of rape cake and wheat bhoosa.

In the metabolic trial conducted on kumauni bullocks, the average percentage digestibilities of crude protein, ether extract, crude fibre and nitrogen free extract were found to be 62.6, 18.1, 35.9, and 73.2 respectively. The digestible crude protein, total digestible nutrients and starch equivalent values in lb. per 100 lbs. of dry leaves were found to be 8.45, 54.78 and 43.48 respectively.

The animals recorded positive balances for nitrogen, calcium (CoO) and phosphorus ($P_2O_5$) and maintained their live weights.

The fairly high digestible crude protein and total digestible nutrient values obtained for the leaves, secure for it a place in the list of high class roughages. But on account of the poor palatability, however, the leaves could not be used as a single feed.

### 43. Studies on tree leaves as fodder. Sal (Shorea robusta) leaves.

M. M. Jayal and K. Sahai, Izatnagar.

It is a large deciduous tree but is seldom quite leafless. It usually attains a height of 100 to 150 feet and a girth of 20 to 25 feet.

The percentage chemical composition of the green leaves, on dry basis, was found to be : crude protein 10.06, ether extract 3.22, crude fibre 27.43, nitrogen free extract 55.41, calcium (CaO) 1.08 and phosphorus ($P_2O_5$) 0.27.

On feeding these leaves to hill bullocks it was found that the daily average consumption of the green leaves did not increase beyond 10 lbs. Since this quantity was insufficient to meet the dry matter and digestible crude protein requirements the leaves were supplemented with the requisite quantity of wheat bhoosa and rape cake.

In the metabolic trial conducted on six kumauni bullocks, the percentage digestibilities for crude protein, ether extract, crude fibre and nitrogen free extract in Sal leaves were found to be 11.4, 36.5, 24.2 and 58.2 respectively. The digestible crude protein, total digestible nutrients and starch equivalent values in lb. per 100 lbs. of the dry leaves were found to be 1.14, 42.6 and 26.3 respectively.

The balance for nitrogen and calcium (CaO) were positive although the phosphorus balance was found to be slightly negative. The animals maintained their body weights during the metabolic trial.

The observations indicate that the leaves could, under scarcity conditions, be used as a part roughage for feeding bullocks.

### 44. Studies on tree leaves as fodder. V. Haldu (Adina cordifolia) leaves.

B. S. Gupta, Izatnagar.

This tree is commonly found at the foot of the Himalayas in the submountaneous and Tarai or Bhabhar regions of Uttar Pradesh. In these regions, the leaves of this tree form one of the common fodders for feeding the cattl.

On chemical analysis the dry leaves were found to contain 9.50 per cent crude protein, 4.80 per cent ether extract, 14.0 per cent crude fibre, 64.08 per cent nitrogen-free-extract, 7.61 per cent ash, 2.48 per cent CaO and 0.85 per cent $P_2O_5$.

The leaves were fed to Kumaoni bullocks, were not relished and the consumption did not exceed about 10 lb. of the green stuff.

To study their nutritive value the leaves along with wheat bhoosa and rape cake to make up for the dry matter and crude protein requirements, were fed to six Kumaoni bullocks. The digestible crude protein, total digestible nutrients and starch equivalent values per 100 lbs. of dry leaves were found to be 2.66, 50.90 and 42.99.

The balances for nitrogen, calcium and phosphorus were positive and the animals maintained good health and recorded an average increase of 6 lb. in live weight during the experimental period.

The observations indicate that Haldu leaves can form a good roughage for Kumaoni bullocks.

### 45. Sandhur (Botherichola Intermedia) grass hay as feed for cattle.

P. Sahai, Izatnagar.

Sandhur is a tufted perennial grass which grows widely in different parts of the United Provinces. It requires a moderately moist climate for its growth and flowers in cold weather. The hay used in the present investigations represents the October cut of the grass.

On chemical analysis the hay was found to contain 4.18 per cent crude protein, 1.5 per cent ether extract, 43.17 per cent crude fibre, 41.99 per cent nitrogen-free-extract, 0.44 per cent lime (CaO) and 0.52 per cent phosphorus (P.O ).

To determine the nutritive value of hay, feeding experiments were conducted on cattle. Sandhur hay was fed *ad lib.* supplemented by a small quantity of rape cake. The hay was found to be fairly palatable. The average digestibility coefficients for crude protein, ether extract and total carbohydrates were found to be 19, 52, and 61 respectively. The digestible crude protein, total digtstible nutrients and starch equivalent values were found to be 0.79 lbs 54.5 lbs. and 29.14 lbs. respectively per 100 lbs. of hay on dry basis. All the animals were in positive balance with respect to nitrogen, calcium and phosphorus.

The observations indicate that as regards its nutritive value sandhur grass hay compares favourably with common hays like juar and spear grass.

### 46. Juar husk as feed for cattle.

B. Sahai and S. L. Talwar, Izatnagar.

Juar is grown extensively in many parts of India viz., Bombay, Madras, Uttar Pradesh, Central Provinces and the Punjab, both as food grain and as fodder. During the preparation of the grain for human consumption, the husk remains as a byproduct, which is not economically utilized. Investigations were carried out to determine the nutritive value of juar husk as feed for cattlt.

On chemical analysis, juar husk was found to contain 5.33 per cent. crude protein, 0.45 per cent ether extract, 29.32 per cent crude fibre, 46.80 per cent nitrogen-free-extract, 0.355 per cent lime (CaO), and 0.305 per cent phosphorus ($P_2O_5$).

Feeding experiments with juar husk were conducted on Harianas bullocks as also on buffaloes. The ration in each case consisted of juar husk fed ad-lib. supplemented with requisite amount of rape cake to meet the digestible crude protein requirement. The palatability of husk was found to be satisfactory. The digestible crude protein, total digestible nutrients and starch equivalent values in lbs. per 100 lbs. of juar husk on dry basis were found to be 1.013, 43.633 and 26.572 respectively for the bullocks and 1.222, 45.172 and 28.099 respectively for the buffaloes.

The above observations indicate that as compared to dry roughages like gram husk, wheat *bhoosa* and rice straw, juar husk contains appreciably higher amounts of digestible crude protein. In energy value it compares favourably with the cereal straws.

## 47. Investigations on Silage making—Berseem-Mango shed leaves Silage as feed for cattle.

N. D. Kehar and B. C. Joshi, Izatnagar.

It was desired whether shed leaves of mango which do not find an economical use at present could be used as cattle feed by ensiling them with green leguminous fodder like berseem.

The shed leaves of mango were ensiled with berseem in the proportion of 3:2 on dry matter basis. The silage had a pleasant fruity odour and green brown appearance.

The percentage chemical composition of the silage was found to be, crude protein 13.23, ether extract 2.39, crude fibre 33.16, nitrogen-free-extract 35.51, total carbohydrates 68.67, total ash 15.71, calcium (CaO) 3.06 and phosphorus ($P_2O_5$) 0.49.

Feeding experiments with Kumaoni bullocks indicated that the silage was highly palatable. The average daily dry matter consumption was found to be 1128.5 gms. per 100 lbs. body weight.

The digestible crude protein, total digestible nutrients and starch equivalent were 3.97, 29.4 and 10.1 lb. per 100 lbs. of silage on dry basis respectively. The animals were in positive balance with respect to nitrogen, calcium and phosphorus and maintained body weights. The above observations point out that berseem mango shed leaves silage can be fed with advantage as a sole feed for cattle and constitutes a maintenance ration.

## 48. Studies on subsidiary feeds. Digestibility and Nutritive value of Mahua flower (Bassia Latifolia).

K. Chandra and B. N. Johri, Izatnagar.

Mahua tree is found growing throughout India. Its flowers have a sweet smell and are relished by cattle when fed after drying. The dired flowers contain:—Total ash 7.79%, crude protein 8.00%, ether extract 1.38%, crude fibre 30.40%, total carbohydrates 82.83%, Calcium oxide 0.31% and Phosphorus pentoxide 0.37%.

A digestibility trial was conducted on three Kumaoni bulls, each weighing about 350 lbs. Their daily ration consisted 6 lbs. of mahua flowers, 4 lbs. of wheat bhoosa and 1 oz. of salt.

The digestibility coefficients of crude protein, ether extract and total carbohydrates were found to be 46, 70 and 83 respectively.

The digestible crude protein, total digestible nutrients, and starch equivalent were found to be 3.68, 73.7 and 55.1 lbs. per 100 lbs. of dry matter respectively. The animals maintained a positive balance for nitrogen and calcium but the phosphorus balance was slightly negative.

The flowers when fed to cows in milk as a part of the concentrate mixture, showed no adverse effect on milk yield and its composition

### 49. Rice husk as cattle feed.

K. Chandra and P. N. Johri, Izatnagar.

Rice is grown extensively through out India. The grain is used for human consumption and straw as cattle feed, while the husk is thrown away as a waste.

On chemical analysis the husk was found to contain : Total ash 15.36 per cent, Crude protein 6.07 per cent, ether extract 0.59 per cent, fibre 28.00 per cent, nitrogen-free-extract 49.98 per cent, total carbohydrates 77.98, calcium 0.32 per cent and phosphorus 0.83 per cent.

A digestibility trial was conducted on four Kumauni bullocks, with an average live weight of 375 lbs. Their daily ration consisted of rice husk 2.5 lbs., wheat bhoosa 2.5 lbs., rape cake 1.0 lb. and common salt 1 oz.

The digestibility coefficients of crude protein, ether extract, crude fibre, nitrogen-free-extract and total carbohydrates were found to be 38, 48, 26, 38 and 34 respectively.

The nutrive value of rice husk was found to be 2.307 lbs. of digestible crude protein, 29.20 lbs. of total digestible nutrients and 13.00 lbs. starch equivalent per 100 lbs. dry matter. The animals maintained positive balance for nitrogen, calcium and phosphorus.

*Alkali Treatment of Rice husk*

An effort was made to see if alkali treatment would improve the rice husk for animal consumption.

The chemical composition of the alkali treated husk was found to be : Total ash 19.50 per cent, crude protein 4.30 per cent, crude fibre 36.25 per cent, ether extract 2.11 per cent, nitrogen-free-extract 37.54 per cent, calcium 0.20 per cent and phosphorus 0.24 per cent.

Feeding trial was conducted on four Kumaoni bullocks. The animals showed no better liking for the treated husk. After about four days feeding a few ulcerated focci were seen in the tongue of these animals.

One of these animals died and the post-mortem examination revealed gastric impaction and dysentric and ulcerative enteritis.

Alkali treatment does not seem to improve the quality of husk.

### 50. Studies on tree leaves as fodder. III. Gular (Ficus glomerata) leaves.

S. A. Momin and B. N. Mazumdar, Izatnagar.

It is a large tree abundantly found in the sub-Himalayan forests from Punjab eastwards. Twigs and leaves are used in certain parts as fodder during periods of scarcity.

Chemical analysis showed that the leaves on dry basis contain 11.16 per cent crude protein, 12.27 per cent crude fibre, 71.27 per cent total carbohydrates, 3.75 per cent CaO and 0.71 per cent $P_2O_5$.

To determine the nutritive value, the leaves were fed to three goats of almost the same age and live weight. The leaves were very much relished and the average consumption on dry basis was found to be 2314 gms. per 100 live weight per day.

The digestible crude protein, total digestible nutrients and starch equivalent per 100 lbs. of the dry leaves were found to be 6.69, 53.82 and 47.26 respectively.

The balances of $N_2$, calcium and phosphorus were positive in all cases.

The steady weight and the satisfactory healthy condition of the animals throughout the experimental period tend to prove that Gular leaves form maintenance ration for goats.

### 51. Investigation on silage making. (Pipal (Ficus religiosa) leaves silage.

P. N. Johri and S. L. Talwar, Izatnagar.

In an attempt to conserve green fodders it was considered desirable to study if green pipal leaves would make a suitable silage. The green leaves were ensiled by the usual procedure adopted in these laboratories.

The percentage composition of the original feed and the silage was as follows:—

(a) Green leaves:—Crude protein 7.36, crude fibre 27.92, ether extract 2.02, nitrogen-free-extract 46.65, total ash 16.05, calcium 3.415 and phosphorus 0.286.

(b) Silage of leaves:—Crude protein 8.50, crude fibre, 32.21, ether extract 2.11, nitrogen-free-extract, 40.73, total ash 16.45, calcium, 3.514 and phosphorus, 0.363.

The ensiled material was highly relished by animals and the consumption per 100 lbs. body weight was 905.5 gms.

In order to determine the nutritive value of the silage a metabolism trial was conducted on four Kumaoni bullocks of an average body weight of 387 lbs. The average digestibility coefficient for crude protein, ether extract, crude fibre, and nitrogen-free-extract were found to be 43, 38, 21 and 44 respectively.

The digestible crude protein, total digestible nutrients and starch equivalent were found to be 3.655, 30.3 and 11.1 lbs. per 100 lbs. of silage on dry matter basis respectively. The animals were in positive balance for nitrogen, calcium and phosphorus.

The animals maintained a general healthy condition during the feeding regime and reflected on an average an increase of five lbs. in live weight during the period of observation.

### 52. Studies on tree leaves as fodder. VI. Sandhan (Ougeinia dalbergiodes) leaves.

M. M. Jayal and B. S. Gupta, Izatnagar.

It is a middle-sized tree, commonly found in Dehra Dun and Saharanpur forests, Siwaliks and in the outer Himalayas. The leaves and twigs are commonly lopped for cattle fodder.

On chemical analysis the leaves were found to contain 11.61% crude protein, 4.32% ether extract, 26.50% crude fibre, 47.57% nitrogen-free-extract, 10.00% total ash, 3.35% calcium oxide (CaO), and 0.68% phosphorus pentaoxide ($P_2O_5$).

The leaves were fed to six adult Kumaoni bullocks and the average daily consumption was found to be 846.42 gms. (on dry basis) per 100 lb.

live weight per day. This indicates fair palatability of the leaves. The leaves were fed for about a month and during the last ten days a metabolism experiment was performed.

The digestible crude protein, total digestible nutrients, starch equivalent values per 100 lb. dry leaves were found to be 3.72, 45 57, and 29.36 respectively.

The balances for nitrogen, calcium and phosphorus were positive and the experimental bullocks recorded, on an average, an increase of 8.70 lb. in their body weights.

The results indicate that sandhan leaves, when fed as a sole feed, can form a maintenance ration for Kumaoni bullocks.

### 53. Studies on tree leaves as fodder. Part I: The Chemical composition as affected by the stage of maturity.

N. D. Kehar, B. N. Majumdar and S. A. Momin, Izatnagar.

In order to meet the keen shortage of fodder for feeding livestock an investigation was started to find out if the tree leaves could be utilized as fodder under scarcity or normal conditions. This article which constitutes the first of the series deals with chemical composition of leaves as affected by progressive maturity.

Bimonthly loppings were obtained of 17 species of tree leaves from 2 localities, one in the plain and the other in the sub-montane area of Uttar Pradesh. The loppings were obtained from November to March--a period which is considered to be the weakest link in the supply of roughage for livestock. The samples were analysed for crude protein, ether extract, crude fibre, total ash, lime, phosphate, magnesia, chlorine, sulphur, potash and soda. The main findigns were as follows:—

(1) In the young stage of growth the leaves contain fairly high amounts of crude protein and comparatively low percentage of fibre. With increasing maturity leaves suffer a progressive dimunition in respect of their crude protein content, while contemporaneously with this change the fibre content undergoes a corresponding increase.

(2) Leaves are generally rich in eher extract and somewhat poor in nitrogen-free-extractives.

(3) Leaves are extra-ordinarily rich in lime content which increases as the leaves progress in maturity, whereas the phosphoric acid, which is highest in the early stages of growth, shows an opposite variation. The variation in magnesia follows, more or less, that of lime. The potash content is highest in the early samples and falls off consistently as the leaves mature. Leaves are generally poor in soda.

### 54. Studies on tree leaves as fodder. Part II: The chemical composition as affected by locality.

N. D. Kehar, B. N. Majumdar and S. A. Momin, Izatnagar.

In order to study the result of environmental factors on the chemical make up of leaves of similar tree species growing in different localities, an investigation was undertaken to find out if any changes are produced in the different components due to locality differences.

For this purpose 17 species of trees were selected. Leave samples of each species were received from two localities in Uttar Pradesh as follows:—

(a) Samples of Babul, Neem, Bargad, Gular, Pakar and Pipal from two localities both situated in the plains (Clutterbuckganj (Bareilly), Etawah or Bahraich).

(b) Samples of Haldu, Bakli, Pula, Sanjna, Sandan, Padal and Sain from two localities both situated in the submontane area (Mohand (Hardwar) and Haldwani).

(c) Samples of Tut, Kachnar, Dhaman and Ber from two localities—one situated in the plains viz., Clutterbuckganj, Etawah or Bahraich and the other in the sub-montane region, Mohand.

The samples were analysed for crude protein, ether extract, crude fibre, total ash, lime, phosphate, magnesia, chlorine, sulphur, potash and soda. The results, on statistical analysis, do not reveal any notable significant difference in composition of these fodder leaves as a result of the locality of their origin. Only in the case of Neem in the plain vs. plain group and that of Pula in the sub-montane vs. sub-montane group phosphate values showed significant variation between the two places.

### 55. Chemical composition and nutritive value of Giant Star (Cynodon plectostachyum) grass hay at the pre-flowering stage.

K. Chandra and M. M. Jayal, Izatnagar.

Giant star is a perennial grass which grows mainly in sandy soils. It resembles dub (Cynodon dactylon) grass in its mode of growth. The grass grows with a heavy foliage, giving high yields.

The percentage chemical composition of the grass, on dry matter basis, was found to be:—crude protein 6.43, ether extract 0 57, crude fibre 35.63, nitrogen-free extract 50.59, ash 6.78, calcium (Ca) 0.31 and Phosphorus (P) 0.37.

To determine the nutritive value, Star grass supplemented with rape cake, to make up the digestible protein and dry matter requirement was fed to Kumauni bullocks. The average percentage digestibilities of crude protein, ether extract, crude fibre and nitrogen-free extract were found to be 51.74, 18.71, 61.82 and 29.23 respectively. The digestible crude protein, total digestible nutrients and starch equivalent values in lbs. per 100 lbs. of the dry grass were found to be 3.25, 37.52 and 14.73 respectively. The animals recorded positive balances for nitrogen, calcium and phosphorus and maintained body weight throughout the experiment.

The highly palatable and nutritious nature of the grass is clear from the fact that it was relished by the experimental animals and the consumption of the grass was as high as 917.86 gms. per 100 lbs. body weight.

It appears from the above observations that Giant Star grass supplemented with rape cake can form a suitable ration for livestock. The grass is found to be rich in crude protein and minerals—especially phosphorus, but due to its low energy value, it is not considered a valuable fodder for working animals.

### 56. The chemical composition and nutritive value of Baib (Eulaliopsis binata) grass at the pre-flowering stage of maturity.

K. Chandra and M. M. Jayal, Izatnagar.

Baib grass in sandy soils and has been found effective in checking soil drifts and sheet erosion caused by rainfall. It is used in paper making industry and also for other domestic purposes.

The percentage chemical composition of the hay was found to be:—crude protein 4.12, ether extract 1.60, crude fibre 38.32, nitrogen-free extract 48.27, total carbohydrates 86.59, total ash 7.69, calcium (Ca) 0.36 and Phosphorus 0.16 respectively.

The nutritive value of the grass was determined by running a metabolism trial on Kumauni bullocks. The animals were fed on the hay for thirty days, supplemented with the requisite quantity of rape cake so that they received a maintenance ration. The average percentage digestibility of crude protein, ether extract, crude fibre and nitrogen-free extract were found to be 32.19, 26.71, 69.09 and 55.14 respectively.

The digestible crude protein, total digestible nutrients and starch equivalent values in lbs. per 100 lbs. of the dry hay were found to be 1.33, 55.74 and 29.94 respectively. The animals were on positive balance for nitrogen, calcium and phosphorus and maintained their body weight throughout the experimental period.

Baib grass at the pre-flowering stage of growth is well relished by animals. On an average they consumed hay at the rate of 930.42 gms per 100 lbs. body weight.

The above metabolism trial shows that Baib grass at the pre-flowering stage of growth is suitable for livestock.

### 57. The chemical composition and nutritive value of Anjana (Cenchrus ciliaris) grass hay at the post-flowering stage of maturity.

K. Chandra and M. M. Jayal, Izatnagar.

Anjana grass grows in the Punjab, Rajputana, Indo-gangetic plain and other sandy soils of the country. When once established it is not seriously affected by droughts. It is reputed to be a nutritious grass for the cattle and increases milk production of the milch cattle.

The percentage composition of the hay, on dry basis, was found to be:—crude protein 5.50, ether extract 0.89, crude fibre 35.19, nitrogen-free extract 45.73, total ash 12.69, Calcium (Ca) 0.44 and Phosphorus (P) 0.41.

The nutritive value of the grass was determined by running a metabolism trial on Kumauni bullocks. The animals were fed on the Anjana grass hay supplemented with some rape cake so as to meet the digestible protein and dry matter requirements. The average percentage digestibilities of crude protein, ether extract, crude fibre and nitrogen-free extract were found to be 29.54, 53.97, 67.93 and 38.35 respectively.

The digestible crude protein, total digestible nutrients and starch equivalent values in lbs. per 100 lbs. of the dry hay were found to be 1.63, 44.15 and 21.30 respectively. The animals recorded positive balances for nitrogen, calcium and phosphorus and maintained body weight throughout the experimental period.

Anjana grass at the post-flowering stage of growth is relished by the animals fairly well and they consumed 905 lbs. of it, on an average per 100 lbs. body weight.

It is clear from the above that Anjana grass at the post-flowering stage is relished by cattle and it can form a suitable ration for livestock in combination with a suitable amount of cake.

### 58. Digestibility and Nutritive Value of Hay Mixture.

P. N. Johri and B. S. Gupta, Izatnagar.

A hay mixture composed of Hetropogan Contortus (Sarwala) 28.6%, Iscilema Laxum (Musel) 39.6%, Ermopogan fabeolatus 26.6% and Andropogon pumilus, Temeda species, Alpuda mutica etc. 5.1% was chemically analysed:—crude protein 6.8, ether extract 1.08, crude fibre 41.60, Nitrogen free extract 39.82, total ash 10.7, Calcium oxide 0.63, and Phosphorus pentaoxide 0.43.

Digestibility and nutritive value of hay mixture was determined by using adult Kumaoni bullocks of an average body weight of 404 lbs. During the feeding period of about a month the animals recorded an average gain of 6 lbs. per head and maintained a general healthy appearance. The hay mixture was consumed at the rate of 1.8 lbs. per 100 lbs. body weight, showing that it was fairly palatable.

The digestibility coefficients of hay mixture were crude protein 41, ether extract 39, crude fibre 43, Nitrogen free extract 57, and total carbohydrates 50.

The digestible crude protein, total digestible nutrients and starch equivalent values in lbs. per 100 lbs. of hay mixture were 2.79 lbs., 44.45 lbs. and 20.0 lbs. respecttively.

The experimental animals recorded positive calcium, phosphorus and nitrogen balances.

### 59. Digestibility and Nutritive Value of Hay Mixtures.

P. N. Johri and N. K. Ayyar, Izatnagar.

A hay mixture of Alpudarnutica (Bhaujura) 11.9%, Schima nervousum (Saini) 58.2%, Heteropogon Contortus (Sarwala) 20.9% and Andropogon pumilus, Iseilema Laxum, Ermopogoi fabeolatus etc. 9.0% was chemically analysed and was found to contain:—crude protein 4.81 per cent, ether extract 1.63 per cent, crude fibre 44.12 per cent, nitrogen-free-extract 35.41 per cent, total ash 14.01 per cent, Calcium oxide 0.74 per cent and Phosphorus-penta-oxide 0.66 per cent.

A metabolic trial was conducted on six Kumaoni bullocks of an average body weight of 414 lbs. in order to determine the digestibility and the nutritive value of the hay mixture. During the feeding regime of a month the animals recorded on an average an increase of 3.3 lbs. and the consumption of the mixture was at the rate of 758.44 gms per 100 lbs. body weight.

The digestibility coefficient of the hay mixture for crude protein, ether extract, crude fibre, nitrogen-free-extract and total carbohydrates were 16, 65, 68, 32, and 52 respectively.

The digestible crude protein, total digestible nutrients and starch equivalent value in lbs. per 100 lbs. of hay mixture were 0.77 lbs. 44.52 lbs. and 18.51 lbs. respectively.

The average mineral balances in gms. per day for lime, phosphate and nitrogen are—0.95, +3.67 and +2.77 respectively.

### 60. Minerals for cattle on sand and muck soils.

R. B. Becker, P. T. Dix Arnold and George K. Davis, U.S.A.

Supplemental mineral requirements of cattle on some types of soils in the United States of America are discussed. Phosphorus deficiency was more severe when dairy cattle received forages grown on a low-phosphorus area in Minnesota following a year of low rainfall. Cattle on light or gray sand soils in the Coastal Plains recovered from nutritional anemia when changed to pastures on reddish or yellowish soils, or those containing some clay. Deficient sands contained 0.016 p.p.m. or less of acid-soluble cobalt; 2.81 p.p.m. of copper, and as little as 0.086% or iron. "Healthy" soils analysed contained at least as much as 0.150 p.p.m. of acid-soluble cobalt, 6.46 p.p.m. of copper, and 0.134% of iron. Phosphorus deficiency occurred on a soil with 0.003% of total phosphorus but was no lower than marginal on soils with 0.005% or above. Use of a mineral supplement containing salt-iron-copper-cobalt in definite proportions obviated the necessity of moving malnourished cattle from the deficient to "healthy" soils.

Forages produced on muck soils and containing below 5 p.p.m. of copper, or above 3 p.p.m. of molybdenum associated with low copper, caused malnutrition in cattle. This was corrected by using a limited amount of copper sulfate but, to avoid copper toxicity, it was advantageous to replace part of the copper sulfate with copper oxide. Traces of cobalt also were necessary for cattle on these muck soils.

To supplement calcium-deficient forages for milk cows, 2.0% of feeding grade steamed bonemeal, or 1.0% each of bonemeal and marble dust ($CaCO_3$) prevented restriction of milk production and favored strong bones. Common salt was needed in the Coastal Plains area, but there was no deficiency of iodine nor deleterious excess of selenium. Excess fluorine had to be guarded against in selection of phosphorus supplements.

### 61. Investigations on silage making—lucerne and shed shisham leaves as feed for cattle.

I. Kumar and S. L. Talwar, Izatnagar.

Continuing the studies on ensilage, shed shisham leaves were ensiled with green lucerne in the proportion of 3:4 on dry matter basis. The silage prepared had a characteristic sweet odour and greenish brown appearance.

The original crop mixture on analysis was found to contain 17.97%, crude protein, 1.95%, ether extract, 30.16%, crude fibre, 39.02% Nitrogen free extract, 2.62%, Lime (CaO) and 0.59% phosphates ($P_2O_5$).

The silage on analysis was found to contain 14.38% crude protein, 3.84% ether extract, 39.06%, crude fibre, 28.49%, Nitrogen free extract, 3.97%, Lime (CaO), and 0.62% phosphates ($P_2O_5$).

To study the palatability and nutritive value of the silage, the silage was fed to four Kumauni hill bullocks. The dry matter consumption per 100 lbs. live weight per day was found to be 836 gms which shows that the silage is fairly palatable. The average digestion coefficients for crude protein, ether extract, crude fibre and Nitrogen free extract were found to be 48.57, 28.88, 46.48 and 28.85 respectively. The digestible crude protein, total digestible nutrients, and starch equivalent values per 100 lbs. of silage on dry basis were 6.98, 34.43 and 10.98 respectively.

All the animals were in positive balance with respect to calcium and phosphorus. The nitrogen balance, however, in the case of two animals was slightly negative.

### 62. Thiamine, riboflavin, nicotinic acid content of neera.

M. N. Guttikar and Kamala Sohonie, Bombay.

Neera is found to be a good source of water soluble vitamins namely vitamin C, thiamine, riboflavin, nicotinic acid. Neera contains protective factors—Sulphahydryl compounds which have stabilizing action towards vitamin C. Addition of lime to neera is the samples studied showed a destruction of vitamin C of the extent of 24-82%. Addition of lime to Neera does not seem to have any significant effect oi the concentration of thiamine, nicotinic acid and riboflavin.

### 63. Effect of lactose feeding in pigeons.

D. P. Sadhu, Calcutta.

There is a correlation between the lactose content of mother's milk and the cerebroside and sphingomyelin in the brain of animals. Feeding of lactose to the pigeons leads to definite changes in the brain and liver. 24 young pigeons were divided into 3 groups, one getting barley alone, one dextrose and the other lactose along with barley. Birds were sacrificed after 4 weeks and their brains and livers extracted. Cerbroside, sphingomyelin, phospholipid and fat were estimated. While the lactose-fed birds show an increase of cerebrosides in brain, dextrose-fed ones show a decrease. Sphingomyelin was decreased in all experimental pigeons, although more so in lactose-fed ones. Phospholipids are increased and fat decreased in the experimental groups. Liver sphingomyelins and phospholipids show a decrease, while fat is increased in the lactose and dextrose-fed pigeons.

### 64. Studies on the Utilization of Vitamin A Part III. Utilization of Vitamin A Palmitate.

G. C. Esh and Sukhamoy Bhattacharya, Calcutta.

With the availability of vitamin A palmitate, the nature of absorption and utilization of this vitamin was studied by feeding the vitamin A deficient rats both small and massive doses given in various media such as arachis oil, ethyl oleate and dispersed in aqueous medium and fortified with different antioxidants. When massive doses (700-800 I.U. daily) were fed consequently for four days and liver storage determined and compared with those after feeding vitamin A alcohol and vitamin A acetate, it was observed that vitamin A palmitate gave the highest liver storage from all the media studied, aqueous dispersion gave the highest liver storage. It is interesting to note that when fortified with antioxidants like tocopherol, lecithin or propyl gallate significant increase in the liver storage was fouid from the diluents arachis oil or ethyl oleate but no such increase was observed when the aqueous dispersion was fortified with these antioxidants. When growing vitamin A deficient rats were fed smaller doses (daily 5 I.U. or 20 I.U.) and growth rate studied for 4 wks., the various diluents seemed to have no significant influence on the growth rate and when compared with vitamin A acetate almost identical results were obtained.

### 65. Effect of different levels of carotene on the metabolism of Electrolytes.

S. K. Vaish and N. D. Kehar, Izatnagar.

Adult male and female rats maintained on vitamin A deficient diet were mated. The litters obtained were weaned when the average body weight was 30 gm. Four groups of four litters each having almost the same average weight were selected for experiment.

All the four groups were fed vitamin A deficient diet supplemented with 16 $\gamma$ $\alpha$-tocopherol and 20 I.U. of calciferol per rat per day till the average body weight was about 100 gm. The diet was then supplemented with 0.5 $\gamma$ $\beta$-carotene, 2.0 $\gamma$ $\beta$-carotene and 10.0 $\gamma$ $\beta$-carotene respectively for the 2nd, 3rd and 4th groups. The first group was kept as control. The feeding of the supplemented diet for seven days was followed by a collection period of four days.

The basal ration, and the faeces and urine collected during the metabolic period were analysed for Ca, P, Mg, Cl., Na and K. It was observed that with the gradual increase in the dosage of $\beta$-carotene, within the experimental range, the absorption of Ca, Mg, P and Cl was improved, whereas in the case of Na and K a depression in the absorption was noticed. The above data were also put to statistical examination. The 't'' values in the case of Mg, Cl, Na, and K were found to be significant.

### 66. Studies on the effect of acetoacetate and $\beta$-Hydroxy butyrate on vitamin $B_2$ and nicotinic acid.

M. C. Nath and C. H. Chakrabarti, Nagpur.

1. Rabbits injected with sodium salt of $\beta$-hydroxy butyric and acetoacetic acid show a state of vitamin $B_2$ and Nicotinic acid deficiency.
2. Nicotinic acid and riboflavin level in the blood of these animals are lowered considerably. The observed decrease is 33.8% and 47.4% respectively.
3. Daily excretion of these vitamins in urine is lowered considerably. The observed decrease in the nicotinic acid excretion is 81.5% and $B_2$ is 60.5%.
4. The animals show severe skin lesions over nose, face, legs and paws.

### 67. Institutional Feeding Experiments to evaluate the effect of replacing 25% of rice by an equal quantity of tapioca soji or flour, on the general health and nutritional status of children.

V. Subrahmanyan, Saranya Kumari Reddy, T. R. Doraiswamy and

M. Swaminathan, Mysore.

The aim of the investigation was to determine the extent to which tapioca can replace rice and other cereals, without affecting the overall nutritive value of the diets. The experiment was conducted at a local orphanage. The children (girls, ages 4-12) were divided into two groups. One group served as the Control-Group and received the usual orphanage diet, whilst the other group served as Experimental Group, and received a diet similar to the Control Group with the difference that 2 ozs., of rice were replaced by 2 ozs., of tapioca. Heights and Weights were recorded and nutritional status was assessed according to the score card worked out by the N.A.C., I.C.M.R. In addition to the above determinations the following laboratory investigations were carried out both at the beginning and end of the investigation: (1) Haematalogical Studies—R.B.C. Count and Haemoglobin and (2) Total protein, albumin and globulin in serum.

The experiment was conducted for six months.

Results were submitted to statistical evaluation and it was found that there was no evidence to indicate a significant difference between the two groups with respect to any of the characteristics measured.

### 68. III. Nutritive value of Tamarind Seeds (Tamarindus indicus) and Indigofera glandulosa seeds.

S. M. Bose, M. Swaminathan and V. Subrahmanyan, Mysore.

The biological values of the proteins of tamarind seeds and of *indigofera glandulosa* seeds were determined by the rat growth method at 10% level of protein intake and were found to be 1.53 and 1.02 on the average. Different series of experiments on the over-all growth of rats receiving "poor tamarind seed diet" (i e. rice of poor South Indian rice diet was completely replaced by tamarind seed powder) with or without supplements of carbohydrates, minerals and vitamins were carried out. The results indicated that although the proteins of tamarind seeds was fairly good, the poor tamarind seed diet on the whole was lacking in the other dietary essentials, viz., calories (due to non-availability of carbohydrate) and minerals. Supplementation of the diet with one or the other was not enough for the growth of rats. However, when the diet was supplemented with both carbohydrate and minerals, average weekly growth of rats was found to be 7.2 gms. The supplementation of the diet with vitamins along with minerals and carbohydrates did not give any extra growth. Animal experiments on partial replacement of rice of the poor rice diet with tamarind seeds are in progress.

### 69. Investigations on some little known foods: III. The Nutritive value of the Seed Proteins of Sesbania grandiflora, Pers.

N. Subramanian, M. V. Lakshminarayan Rao and M. Srinivasan,

The decorticated seeds of *Sesbania grandiflora* gave on analysis: Moisture 10%; crude protein 70%; ether extractives 11%; and ash 5%. At 10% level in the diet, the whole seed protein has a biological value of 35.6±1.88 as measured by nitrogen balance in adult rats and does not support growth in weanlings. Autoclaving at 15 lbs. pressure for half an hour or even supplementation with casein at high levels does not markedly improve the biological value. Replacement of thur dal in the conventional poor rice diet with the seed material adversely affects growth. The trend of the results suggests that this protein falls in the class of incomplete proteins, which are grossly deficient in one or more essential amino acids.

### 70. Nutritive value of 'Trapa' (water-chestnut) seeds.

S. Kuppuswamy and M. Swaminathan, Mysore.

Analysis of 'tropa' (water-chestnut) seed showed that it contains nearly 10% protein, 2% ash and less than 1% fat.

The overall nutritive value of 'trapa' seeds was compared with that of rice and millets by the rat-growth method using poor diets based on these seeds, rice, ragi and jowar. The growth-promoting value of the 'trapa-seed' diet was significantly higher than that of the poor rice diet. It was of the same order as that of jowar diet, but less than that of ragi diet,

### 71. The effect of partial replacement of rice in poor rice diet by synthetic grains on the retention of nitrogen, calcium and phosphorus in adult human subjects.

H. B. N. Murthy and M. Swaminathan, Mysore.

The metabolism of Nitrogen, Calcium and Phosphorus was studied in six adult human subjects fed on poor vegetarian diets based on rice and a mixture of 75 parts of rice and 25 parts of synthetic grains (prepared from a mixture of 90 parts of Tapioca flour and 10 parts of Groundnut cake flour). The control rice diet was so constituted as to simulate the average diet of the poor rice eater. The experimental diet was replaced by synthetic grain. The duration of each experimental period was 12 days. The results were as follows:—

(i) When 25% of rice was replaced by synthetic grain the nitrogen intake was not altered but the average daily retention of nitrogen on the rice plus synthetic grain diet (3.6 g.) was definitely greater than on the rice diet (2.64 g.) and

(ii) The average daily retention of Calcium and Phosphorus (205 mg., and 690 mg., respectively) on the rice plus synthetic grain diet was also higher than that (47 mg., and 197 mg. respectively) observed on the rice diet.

### 72. Mashing of ragi malt to obtain malt extract.

M. R. Chandrasekhara and M. Swaminathan, Mysore.

In the preparation of malt extract using ragi malt the choice of the starchy substrate used in the mashing process is of great importance, as it affects the quantity of sugar produced as well as the flavour of the malt extract. The results of experiments using substrates like ragi, tapioca, maize, cholam and wheat flours are given and it has been shown that wheat flour is the best from the point of view of the yield and quality of the malt obtained. The rate of production of reducing sugar from different substrates and the optimum proportion of the starchy substrate to the malt for mashing as well as details of the mashing technique are given in the paper.

### 73. Effect of vegetable proteins on the hæmopoiesis of iron in milk-anæmic rats.

Jagat Jiban Ghosh, Calcutta.

The different types of vegetable proteins had very little effect on the increase of haemoglobin level of milk-anaemic rats. It was surmised that the vegetable proteins did not add to the value of milk proteins themselves regarding haemopoiesis although they supplemented the milk poteins to some extent as regards promotion of growth. Iron alone seemed to be the limiting factor for haemopoiesis in milk anaemia.

### 74. Effect of vegetable proteins on the hæmopoiesis of iron in rats, with ferric chloride as the source of iron.

J. J. Ghosh, Calcutta.

In continuation of the work on the effect of vegetable proteins on the utilisation of dietary iron, a detailed investigation has been made on the haemopoietic effect of three vegetable proteins *viz.* gliadin, glutelin from wheat and globulin from peas.

The experiment was carried out with young rats which were made nutritionally anaemic by adopting the technique described in the previous experiments. When rats were 6 to 7 weeks old, the haemoglobin level came down to 40 to 60%. The rats were then divided as evenly as possible into three groups (besides one control group receiving milk only) with respect to set, body weight and haemoglobin level. The first group was given glutenin, the second gliadin and the third globulin. The diets of the three groups consisted respectively of "Klim" whole evaporated milk *plus* 10% glutenin, gliadin and globulin respectively *ad lib.*

Each of the rats of the above groups received in addition 0.25 mg. of iron as ferric chloride and 0.03 mg. of copper as copper sulphate in 0.1 cc. solution admixed with 5-10 cc. of 10% Kilm milk. Each rat was also given two drops of "Adexolin" weekly. The period of experiment lasted 30 days. Haemoglobin was measured once in 10 days and the haemoglobin levels were compared in order to assess the haematopoietic effects of the vegetable proteins in the diet.

The results indicate that with all the different types of vegetable proteins tried the haemoglobin level increased equally during the experimental feeding period. But this increase in haemoglobin level was not apparently related to the presence of the vegetable proteins in the diet, since the control group receiving milk only, not supplemented with vegetable proteins, registered the same rise in haemoglobin level. It will be recalled that similar results were obtained previously when animal proteins like lecitho-vitellin egg-albumin and casein were fed. It is therefore clear that in milk anaemia, the effects of these different vegetable and animal proteins as regards haemopoietic activity are not significantly different from each other. Nor do they add to the value of milk proteins themselves regarding haemopoiesis although they do supplement the milk proteins to some extent as regards promotion of growth. Iron alone seems to be the limiting factor for haemopoiesis in milk anaemia.

### 75. On the characteristics of pharmacopoeial adrenaline (natural) arising out of its association with nor-Adrenaline.

S. K. Ganguly, Calcutta.

Presence of nor-adrenaline in adrenalin from natural source necessitates further consideration for ascertaining the specifications of pharmacopoeial adrenalin. Some samples of adrenalin base local and foreign, have been studied and their melting points, specific rotation, strength by chemical and biological assay on spinal cat have been recorded. In almost all of these samples slightly higher strength by biological assay and lower values for melting point, and specific rotation than those specified in the standard pharmacopoeia for adrenaline are noted. Association of nor-adrenalin with such adrenalin (natural), could be found out by chromatographic analysis.

Suggestion has been made to the effect that while recommending for a limit of nor-adrenaline in pharmacopoeial adrenalin, due consideration also be made regarding the change in the chemical characteristics, arising out of its association with nor-adrenaline.

### 76. On the response of assay organisms to Vitamin $B_{12}$.

A. N. Bose and S. Ghosh, Calcutta.

During the assay of Vitamin $B_{12}$ in Liver Extract by the cup-plate method using *Lactobacillus leichmannii*, 313 and *Escherichia* Coli 301 (mutant strain), it is being observed that the zones formed by *E. Coli* are definitely greater than those of *L. leichmannii* Moreover multiple-zone formation is more marked with *L. leichmannii* than with *E. Coli*. No difficulty is encountered in the assay of pure vitamin $B_{12}$ solutions of purified liver extracts using any of the strains. But with crude liver extracts or proteolysed liver powders, the assay values obtained before chromatography are defenitely far greater than are expected from their Vitamin $B_{12}$ content.

### 77. Action of Selenium on Isolated Rabbit Intestines.

M. N. Rudra, Laheriasarai.

The action of very small doses of selenium on isolated rabbit intestines suspended in Dale's bath has been observed Even in presence of very small traces (1 p.p.m.) of selenium the contractions are reduced less than half.

### 78. "Investigation on the mechanism of action of adrenaline on coagulation of blood".

P. B. Sen, J. N. Mukherjee and Ajit Maiti, Calcutta.

Adrenaline hastens coagulation time within five minutes of intravenous injection (0.001 mg. per Kgm. body weight) of adrenaline. It has no action on shed blood. The platelet count is increased considerably after the injection of adrenaline. Adrenaline does not affect the coagulation time in spleenectomised animals where the platelets counts were found more or less unaltered. The hastening of coagulation was possibly due to a greater availability of thromboplastic material and platelets in the circulation, helped by strong spleenic contraction.

### 79. "Studies on the mechanism of action of digitalis on the coagulation of blood."

P. B. Sen, J. N. Mukherjee and Ajit Maiti, Calcutta.

Digitalis has been observed to hasten coagulation. Different groups of workers however are not unanimous about this finding. This investigation shows invivo that 1/20th dil. of Tinct. digitalis administered in constant drip intravenously, shortens the coagulation time only in toxic doses. When oxalated blood or oxalated plasma was incubated for 15 minutes with 1/20th dil. of Tinct. digitalis, considerable shortening of coagulation time was observed on adding calcium. Stored blood however was not similarly affected by digitalis.

### 80. Histopathological changes in Avitaminosis A in sheep.

B. Dutt, Izatnagar.

Young lambs of 2-3 months age were kept on vitamin A deficient diet for about eight months. The dams of these lambs were kept on subadequate supply of green. Such lambs when kept on vitamin A deficient diet for a period of 4-5 months; began to show symptoms of in-coordination of hind legs, stunted growth, opacity of cornea, poor vision, atrophied testis, hooves had grown laterally, wool was coarse and short in size. Skin showed lesions like these of dermatitis.

Briefly described, the following changes were observed on histopathological examination in some of the important tissues.

Liver cells were swollen and cytoplasm was granular. Swelling of the liver cells caused the obliteration of the hepatic sinusoids as a result of which there was stasis of blood in intralobular veins. Blood in central veins was partly in the form of clot and partly cellular. There was slight portal cirrhosis. Lungs showed areas of collapse and emphysema. In a sheep which had complication of pheumonia during life, showed histologically alveoli filled with desquamated alveolar cells, plasma cells and histocytes. There were also focal areas of necrosis. Trachea showed changes associated with metaplasia in its epithelial lining of the nucous memberane which is very characteristic of vitamin A deficiency. Normal cliated and columnar lining had been replaced by a multilayered one with a stratified squamous and keratinised layer at the top. Spleen from the sheep which had secondary complications of pneumonia showed atherosclerosis of blood vessels. The blood vessel had a characteristic signet ring appearance. Degenerative changes in the glomerular tuft and proximal tubules were observed. There was slight arteriosclerosis of blood vessels. Abomassum5s mucous memberance showed slight cattarhal changes and foci of round cells infilteration between the glands. Semniferrous tubules of testis were almost collapsed and lined by a single layer of cells and contained fragments of degenerated and necrosed cells. No signs of degeneration were observed in the optic nerve. There was distinct increase of neuroglia cells. Skin showed keratinised core surrounded by epithelial cells which relates to lesions observed clinically in the skin. The epiphysial line at the costo chondral junction was irregular. There was complete absence of proliferation of cartilage cells which indicated signs of malnutrition.

### 81. Clinical changes in lantana poisoning in cattle.

B. Dutt, Izatnagar.

Lantana grows extensively in the plains and has been found flourishing up to a height of 5000 feet. Preliminary experiments showed that the animals did not relish the plant in green condition. Efforts were made to feed the plant after drying in shade, sun or oven. None of these types nor the one dried after boiling in water was found palatable. It was found that, cattle when fed even 12-16 ounces of the leaves showed symptoms of jaundice, exfoliation of skin near the muzzle, profuse salvation, severe dermatitis especially on lobes of ears, root of tail and thigh, high temperature going up to 106°F, loss of appetite and the animals were feeling dull. Photosensitisation developed within a week. Post-mortem examination revealed that all the organs were coloured with bile pigment. Liver was enlarged and showed patches of congestion. Abomassum and intestine were inflamed and showed foci of haemorrhages. Briefly described, the following changes were observed on histopathological examination in some of the important tissues. Liver showed dilatation of bile duct with loss of elasticity. Mucous layer of bile duct was thrown into folds resembling star or stellate arrangement of bronchioles. The usual trabecular arrangement of liver cells was disturbed. Liver cells were swoolen, infilterated and loaded with granules. Sinusoids were congested and a few of the liver cells showed free bile pigments. Intestines showed extensive destruction of mucous layer due to heavy infilteration with blood which had been disintegrated into blood pigments. The villi portion of the mucous layer was cast away and the mucous glands were surrounded by large collection of disintegerated blood. The abomassum mucous layer was infilterated with leucocytes. The free edges of villi showed catarrhel changes and some portions of it were cast away. Congestion of glomerular tuft and inter tubular capillaries was observed. Renal cellular casts and colloid material having deep eosin stain were seen in the tubules.

### 82. Effect of thyroxine administration on milk yield.

K C. Sen, G. K. Murthy and Noshir N. Dastur, Bangalore.

In the first trial, 5 Sindhi cows and 5 Murrah buffaloes were administered thyroxine subcutaneously at the rate of 10 mg. per cow per day, and 12 mg. per buffalo per day. During 10-day experimental period, out of four cows, two showed increased milk production of 14.0 and 19.5 per cent respectively over the control period. There was no response in the two other cows. The total increase in fat production in the four cows was 4.5, 8.9, 15.1 and 38.7 per cent respectively. Only one buffalo showed an increase of 18.0 per cent in milk yield. The increase in total fat production was 2.0, 9.6, 14.7 and 36.3 per cent respectively in the four animals.

In another trial, thyroxine was injected intra-muscularly to two cows and two buffaloes at the rate of 10 mg. per day for a period of ten days.

Of the four animals only one cow responded to the treatment, the increase in milk production being 18.7 per cent, and in total fat production 15.0 per cent.

On the whole Indian animals appeared to be rather slow in responding to thyroxine treatment which is contrary to what has been observed on Western breeds of cows.

### 83. Effect of feeding iodinated casein on the growth and health of calves.

K. C. Sen, G. K. Murthy, S. C. Ray and Noshir N. Dastur, Bangalore.

Young calves varying in age from 6 months to 24 months were fed iodinated casein at the rate of 2 g. per 100 lb. live-weight per day. All the animals were fed individually a balanced ration according to the standard prescription *plus* an extra quota of 25%. Due to the feeding of iodinated casein the growth was markedly retarded compared to that of control animals of the same breed, age and weight which were fed the identical ration. With the withdrawal of iodinated casein supplement, the rate of growth was soon restored. Apart from retardation in growth, the feeding of iodinated casein caused a slight rise in the body temperature and pulse rate.

Metabolism study carried out with selected animals of both the groups to ascertain the comparative efficiency of food utilization with and without iodinated casein supplement showed that animals getting the supplement were retaining significantly lesser amount of nitrogen. There was, however, no difference in the calcium and phosphorus balances in the animals of either group.

### 84. Effect of Pregnant Mare Serum Gonadotrophin on the Characteristics and Oestrogenic Content of the Gel Mass of Rabbit Semen.

D. P. Mukherjee and P. Bhattacharya, Izatnagar.

In previous communications the authors have shown that the gel mass of rabbit semen contains oestrogenic substance and that it is absorbed in the vaginae of immature and adult ovariectomised rabbits causing hypertrophy and hyperaemic conditions of the uteri. In this article it has been shown that the injection of pregnant mare serum gonadotrophin (PMS) upto 250 i.u. to male rabbits increased sperm concentration/ml. and total number of spermatozoa/ejaculated fluid, although the volume of the fluid remained uninfluenced. There was highly significant increase in the quantity of th gel mass/ejaculate due to administration of the hormone.

Subcutaneous injections of altogether 7 gms. of the gel mass at the rate of 1 gm/rat/day for 7 days into 31 days old ovariectomised rats increased their uterine, adrenal and pituitary weights 100 gms. of body weight in comparison with the control ovariectomised rats of the same age. The same quantity of the gel mass obtained after PMS administration to rabbits when injected into another group of ovariectomised rats, there was significant increase in the weights of their organs in comparison with the previous gel injected group. These results indicate that along with the increase in the quantity of the gel mass under the influence of PMS there was an increase in its oestrogenic content also. The histological examination of the adrenal and the pituitary of the rats indicated that along with the increase in the oestrogenic content of the gel mass there was hypertrophy of the adrenal cortex and increase in the acidophile count of the anterior pituitary.

Injection of citric acid (which has been found by Humphrey and Mann, 1949, to be present in a very high concentration in the gel mass) seemed to have little effect on the weights of the organs or on the histological structures of the adrenal and the pituitary but it decreased the body weights of rats. There is further indication that the gel mass may contain a substance or substances which increase the body weight of rats and which may also increase under the influence of PMS.

### 85. Studies on the effects of testicular hormone on the alkaline phosphatase activities of different tissues of rats.

Pulak Kumar Ghosh and Sachchidananda Banerjee, Calcutta

Effects of Testicular hormone on the Alkaline Phosphatase activities of different tissues of rats were studied histochemically. Twelve male rats were divided into four groups, each group consisting of three rats. The rats of the first group were kept as control, those forming the second group were all castrated while the vas deference of the third group rats were tied by operation. Each of the fourth group rats received injections of Testosterone Propionate

The alkaline phosphatase activities of the different tissues of the experimental rats were then studied by Gomori's technique. The results of the study will be presented.

### 86. Studies on the metabolism of nicotinic acid in rabbits.

Dhurjatiprosad Chattopadhyay, Naresh Chandra Ghosh, Haripada Chattopadhyay and Sachchidananda Banerjee, Calcutta.

Metabolism of nicotinic acid has been studied in rabbits. Rabbits excrete nicotinic acid, nicotinuric acid, N'methyl nicotinamide and 1-methyl-3-carboxylamide-6-pyridone in their urine. The last mentioned compound forms the principal end product of nicotinic acid metabolism in rabbits. Rabbits do not excrete trigonelline as a metabolite of nicotinic acid as suggested by some workers. Rabbits excrete negligible amount of N'methyl nicotinamide in urine but after the administration of mandelic acid which lowers the pH of the urine appreciable amount of N'methyl-nicotinamide is excreted. The substtance is unstable in alkaline solution and hence in alkaline urine it is destroyed.

### 87. Metabolism of sodium and potassium in scurvy.

Chandicharan Deb and Sachchidananda Banerjee, Calcutta.

To study the adrenal cortical activity in scurvy sodium and potassium contents of blood and the urinary excretion of potassium were estimated in both scorbutic guinea pigs. Scorbutic animals had increastd potasium and diminished sodium content of the blood. They also excreted less potassium in urine. Serum from scorbutic animals diminished the amplitude of contraction of a toad's heart and the rhythmic contractility of an isolated uterus from a scorbutic guinea pig in an organ bath was depressed. Scorbutic guinea pigs seem to suffer from hyposecretion of the adrenal cortex.

### 88. Inter-relationship of Vitamins A and C on the metabolism of chondroitin-sulphuric acid.

D. P. Sadhu, Calcutta.

The mechanism of action of vitamin A in the body is not definitely known. It influences all types of epithelia in the body and its deficiency leads to epithelial keratinisation It also affects cartilage sequendcs in ossification and is thus related to the metabolism of chondroitin sulphate, the latter being also affected in scurvy. Experiments have shown an actual decrease in chondroitin sulphates in scorbutic guinea pigs. Hypovitaminosis in rats reduces ascorbic acid, glutath'one and itin sulphates and increases the thioamino acids in muscles and skin. Hypervitaminosis A in rats causes a decrease in thioamino acids in muscles and skin and an increase in glutathione in kidney and liver and in itin sulphates in all tissues. A new mechanism has been postulated for the biological functioning of vitamin A in the body.

### 89. Evaluation of status of carbohydrate metabolism in normal individuals in Orissa.

J. M. Senapati and K. Subrahmanyam, Cuttack

The status of carbohydrate metabolism has been studied by three methods: (1) The Sugar tolerance test after a dose of 50 gm of glucose, the usual one; (2) The Sugar tolerance test as modified by Exton and Rose; (3) The change in the arterio-venous sugar difference after a dose of 50 gm of glucose, which gives value of sugar utilisation by tissues.

The values are at par with those given in literature with minor differences. The sugar utilisation test shows a mean value of the extremes found by Himsworth under low and high carbohydrate diets

### 90. Influence of pyridoxine on fat metabolism in phrynodema.

S. R. Chowdhury and K. Rajagopal, Calcutta

The available literature in pyridoxine and the essential fatty acids indicates that a synergistic relationship exists between them in maintaining the integrity of dermal tissues in the case of experimental animals. It was reported by the authors (Proc. Ind. Sci. Congress 1950, Med. and Vet. Section, Abs No 72 and Ind. Med. Gaz. August 1952) that phrynoderma responds to treatment with linseed oil and thus possibly lack or inadequacy of essential fatty acids was the cause of the condition. In a preliminary investigation on the value of pyridoxine in phrynoderma it has been found that the cases were "Cured" in six weeks following administration of ¾ oz. of linseed oil plus 50 mg. of pyridoxine by intramuscular injection twice weekly. Favourable results were obtained with linseed oil plus pyridoxine by mouth. There was no influence of pyridoxine treatment alone in phrynoderma either by mouth or by the parenteral route. The findings suggest that pyridoxine has an added influence in healing phrynoderma when it is given along with linseed oil.

### 91. Effect of acetoacetate on succinic acid oxidase system.

M. C. Nath and V. G. Hatwalne, Nagpur.

1. Influence of acetoacetate, an intermediary fat metabolite, on succinic oxidase system has been studied.
2. It has been found acetoacetate inactivates the system, perhaps by competitively reacting with the -SH groups of the enzyme. A very much higher concentration of acetoacetate was required for effective inactivation in presence of succinic acid.
3. $2 \times 10^{3}$mM. acetoacetate completely inactivates the enzyme system. For observable inhibition a minimum of $0.4\text{mM} \times 10^{-3}$ concentration of acetoacetate is required.
4. Reduced glutathione can protect the enzyme system from the effects of acetoacetate. But GSH even in concentrations several times the molar equivalents of acetoacetate cannot completely check the inactivation.
5. The possibility that accumulation of acetone bodies may upset insulin synthesis and Kreb's Tricarboxylic acid cycle is indicated.

### 92. Role of acetoacetate in aggravating the disturbances in the carbohydrate metabolism of scorbutic animals.

M. C. Nath, V. K. Sahu and R. P. Chitale, Nagpur.

1. Some changes in carbohydrate metabolism as effected by continuous administration of acetoacetate, in increasing amounts, to vitamin C denied guinea-pigs, was studied.
2. Continuous acetoacetate injections (intraperitoneal) administered to guinea-pigs, kept on a scorbutic diet, causes a rapid development of hyperglycemia in the animals.
3. A rapid depletion in glycogen storage of liver and leg muscle is observed in vitamin C denied guinea-pigs following the continuous injections of acetoecetate.
4. It has been shown how an intermediary fat metabolite (acetoacetate) which occurs in higher concentrations in the obese persons and causes depletion of vitamin C in normal animals, can cause marked depletion of vitamin C in the animals on scorbutic diets and can aggravate the disturbances in carbohydrate metabolism, thus serving to explain why adiposity is usually found to be a precursor to clinical diabetes.

### 93. The metabolism of nitrogen, calcium and phosphorus in school children on a poor rice diet.

Saranya Kumari Reddy, H. B. N. Murthy and M. Swaminathan, Mysore.

A diet survey conducted at a local orphanage revealed the intake of all nutrients by the children to be very much lower than the requirements recommended by the Nutrition Advisory Committee of the Indian Council of Medical Research. The children were undernourished and their general state of nutrition was low. The average daily intake of calories was only 1300 (per consumption unit). It was therefore felt that a study of the metabolism of nitrogen, calcium and phosphorus would yield interesting results. The investigation was conducted on seven girls (aged between 7 and 11 years). The average daily intake of nitrogen, calcium and phosphorus was 2.946 g. 0.199 g. and 0.547 g. and the average daily retention of the above nutrients was 0.109 g, 0.016 g. and 0.019 g. respectively.

### 94. I. Effect of a high-fat rice diet on the deposition and fatty acids composition of liver-fat of albino-rats.

S. M. Bose and V. Subrahmanyan, Mysore.

Freshly weaned albino rats were fed for four weeks on a poor South Indian rice diet (*minus* fat) and then for four weeks on the same diet supplemented with 30% ghee. The growth rates of rats were noted. The rats were sacrificed and the livers were collected, dried and stored. About one thousand livers were thus collected in twentyfour batches. Forty-eight random samples of livers (two livers from each batch) were individually analysed for fat content. The remaining liver-samples were all mixed together and liver-fat was extracted. The composite liver-fat sample was analysed for the chemical characteristics and for the detailed fatty acids composition by ester-fractionation method. The dietary fat also was analysed for detailed fatty acids composition. The fat content of the livers analysed was found to vary between 6.01 and 9.17% on the fresh weight basis. The component fatty acids of the liver-fat were found to be lauric (0.82), myristic (5.10), palmitic (30.76), stearic (4.43), arachidic (0.25), tetradecenoic (0.87), hexadecenoic (5.50), oleic (40.65), linoleic (7.69) and arachidonic (3.97), and those of ghee were found to be butyric (9.24), caproic (2.36), caprylic (2.40), capric (2.19), lauric (3.60), myristic (9.43), palmitic (23.85), stearic (9.53), arachidic (0.88), decenoic (0.43), dodecenoic (0.36), tetradecenoic (1.52), hexadecenoic (3.88), oleic (25.65), linoleic (3.64) and arachidonic (1.05), all expressed as molar percentages as acids. The results showed that the lower fatty acids of the dietary fat were not deposited in the liver of rats, although the dietary fat were not deposited in the liver of rats, although the dietary fat had a marked influence on the composition of the liver-fat.

### 95. A study on the influence of Vitamin C on work performance of skeletal muscle.

P. Brahmayya Sastry, Visakhapatnam

Information in literature on role of Vitamin C in muscle Phisiology is meagre. Basu and Ray found benificial effects of Vitamin C on the ergograms recorded in three subjects with one control.

In the present investigation 31 subjects were divided into experimental and control groups to make a comprehensive study of the effects of 1/18th, 1/6th and full saturation doses of l-ascorbic acid administered orally over short and long periods on work-performance of flexor muscle of middle finger. Ergograms were recorded on Mosso's ergograph daily in normal period and on alternate days in experimental period. Vitamin C was estimated in three-hour samples of urine on graph-days and in blood plasma[2] at each change in phase of experiment. Work-performance of experimental subjects were corrected with that of controls. Individual and group data were studied.

88% and 12% of the subjects showed respectively an increase and decrease in work performance. 1/18th and 1/6th saturation doses had better effects than saturation dose. Smaller doses over longer periods and larger doses over shorter periods showed marked effects. The data suggest that maximum work-performance was possible at subsaturation level of the body. Ergograms recorded 1½ hours and 6½ hours after Vitamin C intake showed no significant effect.

# *40th INDIAN SCIENCE CONGRESS, LUCKNOW, 1953*

## SECTION OF CHEMISTRY

*President* :—U. P. BASU, D.Sc., P.R.S., F.N.I.,

## ANALYTICAL CHEMISTRY

## *Abstracts*

### 1. Paper partition Chromatography in Standardization of Drugs.

H. K. BANERJEE, Calcutta.

By the application of paper partition chromatography it has been possible to assay the adrenaline content of various B.P. preparations of adrenaline in presence of extraneous substances. Paper partition chromatography has also been applied for the identification of alkaloids of Ergot.

### 2. Mixtures of non-aqueous solvents in Paper chromatography of sugars.

R. K. BOSE and D. P. BURMA, Calcutta.

Mixtures of non-aqueous solvents such as, pyridine-acetone, and ethylene glycol-cellosolve, have been used in the unidimensional development of the chromatograms of sugars. With pyridine alone all the sugars move with the solvent front and with acetone alone they remain stationary at the original starting line. With pyridine-acetone mixtures, however, the $R_F$ values depend upon the line. With pyridine-acetone mixtures, however, the $R_F$ values depend upon the pyridine-content of acetone, the $R_F$ values increase with increase in pyridine-content, just as they do in the case of aqueous developing solvents with increase in water-content. Similar are the observations with ethylene glycol-cellosolve mixture; for instance, with ethylene glycol the sugars move close to the solvent front and with cellosolve they move very little, whereas with mixtures of the two, the $R_F$ values depend upon ethylene glycol content. No composition, however, is found to be suitable for purposes of separation.

It yet remains to be explained whether the different rates of movement are due to differences in adsorption of the sugars on cellulose from the mixed developing solvent or due to the differences in their partition coefficients between the two phases formed on cellulose, one of the phases consisting of a mixture poor in the second solvent.

### 3. Chromatophoresis

D. P. BURMA, Calcutta.

The term 'chromatophoresis' has been used to specify the cases where chromatography and ionophoresis are simultaneously applied for the separation of the constituents of a mixture. While a paper-chromatogram is being developed unidimensionally electric field is applied either in the direction of flow of the developing solvent or at right angle to it. In the case of amino acids, for example. the filter paper is previously treated with buffer at the required pH and the developing solvent too is saturated with it. Colloidal graphite impregnated on the two sides of paper serves as electrodes.

A detailed study with a number of amino acids at different pH with phenol-buffer as the developing solvent has led to interesting results. On ordinary paper acidic amino acids move towards the anode, basic ones towards the cathode, neutral amino acids do not move at all. On buffer treated papers however, the movement depends upon pH interval between the buffer and isoelectric point of the amino acids. For instance, leucines move towards the cathode at $pH_2$ but move towards the anode at PH 6. By choice of suitable pH and application of electric field in proper direction amino acids characterised by very close $R_F$ values (excepting however isomers) can be separated from one other.

### 4. Determination of Thorium by Cresotic acid.

G. S. DESHMUKH, Banaras,

In continuation of earlier work on the use of organic acids and bases for the precipitation of thorium, quantitative results have now been obtained with o-, and p-cresotic acids. The addition of a hot aqueous solution of this acid to thorium chloride or nitrate with pH adjusted between 3-5 throws down a white amorphous precipitate. Gravimetric results for $ThO_2$ obtained by igniting this precipitate compare within experimental error with the initial thorium content of the solution. Trivalent rare earths cause no interference, but zirconium and $Ce^{iv}$ are precipitated under identical conditions and should therefore be absent.

### 5. Potassium iodate—a volumetric standard for thiocyanate estimation.

By G. S. DESHMUKH and M. K. JOSHI, Banaras.

The use of standard potassium iodate in the oxidation of thio-cyanate has been suggested by earlier work on the $KBrO_3$—KCNS reaction. The results show that under appropriate conditions two moles of $KIO_3$ react with three of KCNS and the S atom is oxidized to sulphate. Titration is carried out upto the iodine monochloride end point. Back titration of excess of KCNS from precipitated complex thiocyanate has been found to be useful in the estimation of various elements especially cobalt and nickel. The applicability of the method for micro-determination of these and other metals is under investigation.

### 6. Determination of thiocyanate by potassium bromate.

G. S. DESHMUKH and M. L. KAUL, Banaras.

The quantitative oxidation of thiocyanate by $KBrO_3$ has been studied. The influence of concentration, acidity, rate of addition of the oxidant and temperature on the above reaction was investigated and experimental conditions for obtaining quantitative results have been determined. The method was adopted successfully for the estimation of cobalt by precipitating its cocmplex pyridine thiocyanate and back titrating the excess KCNS against standard bromate solution. Further work on the utility of this procedure foı the determination of Ni, Cd, Pb, Cu, and other complex-forming elements is in progress.

### 7. Studies in the formation of metal tellurates: Estimation of tellurium as lead tellurate.

G. S. DESHMUKH and KRISHNA KUMARI, Banaras.

Series of experiments are carried out to study the quantitative precipitation of lead as lead tellurate. It is observed that the addition of an excess of aqueous lead salt solution to a suitably buffered sodium tellurate precipitates tellurium quantitatively as an amorphous white lead tellurate. This is weighed as such in a sintered glass crucible. As a check the excess lead in the filtrate is also estimated gravimetrically. Under identical condition thallium is not precipitated by sodium tellurate. A reverse process of precipitating lead by excess sodium tellurate is therefore being studied to effect a quantitative separation of lead and thallium.

### 8. Iodometric determination with arsenious oxide. Part II Estimation of silver and cobalt.

G. S. DESHMUKH and M. K. R. PANICKAR, Banaras.

Ferricyanide is usually estimated by precipitating the insoluble silver ferricyanide by excess of silver nitrate and determining the excess silver by Volhard's method. A reverse procedure using excess ferricyanide initially to precipitate the Ag and Co complexes and back titrating the ferricyanide iodometrically by thiosulphate and arsenious oxide to estimate the above elements has now been investigated. The results show that under the given operative conditions the complexes of Ag and Co correspond to the formula, $Ag_3$ $[Fe(CN)_6]$ and $Co[Fe(CN)_6]$, $Co_3[Fe(CN)_6]_2$ respectively. The chief advantage of the procedure is its utility in the direct titrimetric determination of silver and cobalt with arsenious oxide as a primary standard.

### 9. Micro-determination of uranium.

G. S. DESHMUKH and B. R. SANT, Banaras.

Uranium salts in pressence of acetic acid give an intense red colour with alcoholic solution of cresotic acid. The sensitivity of the test under the given conditions has been found to be sufficiently high to detect micro-quantities of uranium, Cu, W, Mo, $Ce^{iv}$, Th and phosphates interfere. The method is being successfully applied for the colorimetric determination of uranium.

### 10. On the iodometric determination of Hydrazine,

G. S. DESHMUKH and SUSHEELA BAI, Banaras,

Earlier observations on the use of arsenious oxide in iodometric estimation have been extended to the interaction of hydrazine with standard iodine and potassium ferricyanide solutions. In both these cases hydrazine is oxidized quantitatively in an alkaline medium and the excess of oxidant is titrated against standard arsenious oxide within a pH range 5·9. The relative proportions of hyrazine and ferricyanide or iodine necessary for the completion of the oxidation process has been determined. A close agreement was observed between the values obtained by these procedures and those calculated from the well-known iodate method. Titration of the ferrocyanide formed during the reaction against standard ceric sulphate has also been carried out as a useful check for the accuracy of the above results.

### 11. Studies in inorganic chromatography.

G. S. DESHMUKH and SUSHEELA BAI, Banaras.

Conditions appropriate for obtaining sharp bands on alumina column have been worked out. Using tubes of uniform dimensions the separation of Sb-Cu-Cd and Fe-Ti has been effected and experiments are in progress to extend the method of chromatographic analysis to the quantitative determination of Sb in stibinite and of Fe and Ti in ilmenite.

### 12. Analytical chemistry of Bismuth: Precipitation by potassium iodate, selenious acid and potassium ferricyanide.

G. S. DESHMUKH and E. T. VARKEY, Banaras.

Results are given for the quantitative precipitation of bismuth with potassium iodate. Direct weighing of the precipitate or iodometric titrations of excess iodate show that the composition of the precipitate corresponds to the formula $BiOIo_3$. Other precipitants like selenious acid potassium ferricyanide are also being used to evolve a convenient method for the gravimetric and also a titrimetric estimation of bismuth.

### 13. A Fluorimetric method for the determination of Aminoacridine Hydrochloride.

J. G. DEVI, M. R. PADHYE, M. L. KHORANA, Bombay.

Aminoacridines have been used as a medicinal dyes for antiseptic preparations. Among the known aminoacridines 5 aminoacridines have the highest antibacterial properties. The official method given in B. P. for the estimation of dye is the volumetric one. The possibility of using a colorimetric method of estimation was investigated but it was not found to be feasible since attempts to develop a colour reaction by usual diaozotisation methods were unsuccessful. A fluorometric method, was, therefore, studied.

Aminoacridines in dilute solutions give a strong fluorescence which visibly appears blue green. The spectroscopic study of the fluorescent spectrum of 5 aminoacridine solution showed that the dye gave fluorescence in the region 4270 to 5780 A° with a strong diffusion band in the region 4470 to 4650 A°. The intensity of emission in the region of fluorescence was, hence, subsequently selected for estimation by selecting a Klett Thiamine filter with a Klett Fluorometer. The intensity of the emitted light has been proved to be independent of pH within the range 4270 A° to 5780 A° and have a linear variation with concentration in the range upto 1 milligram per litre. The proposed method is accurate and require less of time as well as the sample.

### 14. Fibre Content of Indian Tea and Its Relation to the Amount of Non-Tender Stalks Present.

S. N. MITRA, and S. C. Roy, Calcutta.

Presence of excess of non-tender, woody stalks and stems in tea cannot be detected by its caffeine, tannin, water-soluble extracts or ash contents. However, the determination of crude fibre is much more helpful in this respect, and in general teas having fibre per cent over 13.5 (oven-dry basis) may be considered to be admixed with excessive woody stalks and stems. This may be accepted as the upper limit for fibre in good teas.

Tea with a hard stalk content from negligible to about 10 % generally has a fibre content below 13.5 %, and such a tea is, in general, organoleptically good.

In the examination of dust teas, determination of fibre is the only guide to detect the presence of excess or otherwise of non-tender stalks. Therefore, the value of this particular constituent is useful in case of teas in powdered form.

It is, however, risky to calculate the fibre percentage from the value of the non-tender stalks and vice versa, as there does not seen to exist a sharp linear relationship between the two values.

### 15. Colorimetric Determination of Iron with Ethylenediamine-bis-Salicylaldehyde sulphonic Acid.

AJIT KUMAR MUKHERJEE and PRIYADARANJAN RAY, Calcutta.

The paper introduces Ethylenediamine bis-salicylaldehyde sulphonic Acid as a new sensitive, stable and widely applicable colorimetric reagent for ferric iron. During the systematic investigation of a series of Inner complex salts (Ray and Mukherjee, J. Indian Chem. Soc. **27**, 1950, 77 and Proceed. Indian Sci. Cong. Abstract Part. III. 1952, 49,), of Sulphanilamido-salicylaldehyde Sulphonic acid, Aniline-salicylaldehyde sulphonic acid and of Ethylenediamine bis-salicylaldehyde sulphonic acid with metals like Copper, Nickel, Cobalt, Manganese, Uranium and Vanadium, it was observed that Ethylenediamine bis-salicylaldehyde sulphonic acid gives an intensive colour (blood-red) with ferric iron in solution. A deep violet-red inner complex salt with ferric iron has also been described. The paper summarises the results of a systematic and careful study of this new reagent as a colorimetric reagent of ferric iron. The iron complex obtained is highly soluble in water and stable; the colour intensity given by the ferric iron solution is deep, permitting detection of a very small amount of iron (0 3 to 20 p.p.m: Sensitivity 1·2 $\gamma$ ; D=5·02) However, the reagent itself is slightly coloured in aqueous solution but this colour has been found not to interfere with the colour of the iron complex. The reagent was prepared by sulphonating the pure and dry Schiff's base of ethylenediamine bis-salicylaldehyde and was recrytallised from water. The maximum colour production is between the $p_H$ range 2.8 to 5.5 and in the Green (1) i.e. 520 m$\mu$ of the visible spectrum. The colour produced is found to obey Beer's Law over a wide range of concentration and the colour is also stable over a long period.

All determinations were made in a photoelectric colorimeter (Absorptiometer, Hilger-Spekker type). Measurements of maximum absorption of the colour intensity was made in the visible region using a Beckman Quartz Spectrophotometer DU model, using 1 mm. Corex glass transmission cells. All $p_H$ determinations were made with a Cambridge $p_H$ meter. The interference of colour by different foreign ions was also described. No colour or precipitate formation was observed with any of the following ions: Cu, Ni, Co, Al, Mg, Ca, Sn, Mo, Ti, Cd, $No_2$, $NO_3$, $SO_4$, $SiO_2$, $SiO_3$, CH COO, oxalate.

### 16. Lorentz-Lorenz Expression as an analytical constant for ghee (Buffalo).

M. R. NAYAR, S. C. ROY, and S. N. SRIVASTAVA, Lucknow.

The applicabilty of specific refraction $\frac{n^2-1}{n^2+2} \cdot \frac{1}{D}$ as a new analytical constant for oils and fats first pointed out by Nayar, Roy and R, S, Srivastava (Current Science 1950 page 54-56) has now been tested in the case of ghee (buffalo), Data collected from 42 samples obtained at different times from the dairy farms and domestic sources have shown a mean value for the constant of 0.296874 at 40 degree C. with a maximum of 0.296982 and minimum of 0.296681 i,e, with a variation of only + 0.03 to 0.06 %.

6 samples of "Dalda" (Vanaspati) gave a mean value of 0.302990 Readings taken with mixtures of ghee and dalda definitely indicated that the mixture law is obeyed with regard to specific refraction, and that adulteration with dalda even up to 5 % can be detected by this method.

### 17. Estimation of hydroxylamine by potassium ferricyanide.

B. R. SANT, Banaras,

The oxidation of hydroxylamine by alkaline ferricyanide has been investigated. The results show that the pH of the medium is the chief determinant of the oxidation reaction. Using different concentrations of alkali it was found difficult to establish a definite stoicheiometric relation between ferricyanide and hydroxylamine hydrochloride. The discrepancy is especially marked with increasing concentration of the alkali. A buffer containing 8 and 4 % borax and boric acid respectively was used to render the system alkaline and maintain its $p_H$ at about 10. The excess ferricyanide was determined iodometrically after the completion of the reaction against standard arsenite solution. Alternatively, the ferrocyanide formed due to the reduction of ferricyanide was estimated titrimetrically with standard ceric sulphate using ferroin as the indicator. Both these methods yielded reproducible and accurate results which compare favourably with those obtained by classical procedures.

### 18. Iodometric determination with arsenious oxide Part III Estimation of Barium and Lead.

B. R. SANT, Banaras.

Alkali chromates or dichromates precipitate barium and lead quantitatively. The chromates are dissolved in a minimum known quantity of HCl, the liberated iodine due to the addition of potassium iodide is titrated against arsenious oxide after raising the $p_H$ of the medium to about 9 by means of borax-boric acid buffer. The results agree with the standard procedure using sodium thiosulphate.

### 19. The solubility of red phosphorus in organic solvents.

B. R. SANT, M. VENUGOPALAN and E. T. VARKE, Banaras.

The estimation of red phosphorus by ceric sulphate and $KBrO_3$ has been reported earlier. An extension of these results to the determination of the solubility of phosphorus in various inorganic and organic solvents has now been undertaken. Red phosphorus is suspended in the solvent at a given temperature for about 48 hours. An aliquot quantity of the supernatant clear solution is taken in a Kjeldahl type flask with a ground glass seal arrangement for attaching a Liebig condenser. The solvent is evaporated slowly at a low temperature; a known volume of standard ceric sulphate or potassium bromate is introduced in the flask, the condenser is attached and the system refluxed for about 4 hours. The solubility of phosphorus is determined by back titration of the excess of ceric sulphate or potassium bromate. Work is now in progress with isobutyl alcohol, carbon disulphide, benzene and carbon tetrachloride used as solvents for phosphorus.

### 20. Chromatographic Separation of Inorganic Ions on Defibrised Jute Plant Sticks.

BINAYENDRA NATH SEN, Burdwan.

Defibrised jute plant sticks have been used with success in effecting separation of a number of cations. With the help of the plant sticks specially prepared separation of $Hg_2^{++}$ —$Pb^{++}$; $Hg^{++}$ — $Pb^{++}$; $Hg^{++}$ —$Cu^{++}$; $Cu^{++}$ —$Cd^{++}$; $As^{+++}$ —$Sb^{+++}$ —$Sn^{++}$; $Cu^{++}$ — $Fe^{++}$ have been effected.

### 21. Salicylamide—a Colorimetric reagent for Uranium,

DEBABRATA SEN and PRIYADARANJAN RAY, Calcutta.

Salicylic acid and Sulphosalicylic acid give yellow coloration with solutions containing sexivalent uranium. These have been convinently used for its detection and estimation. Salicylamide, $C_3H_4 \overset{CH.}{\cdot CONH_2}$ also produces similar yellow coloration with uranium (VI). With this reagent a method has been developed for the colorimetric estimation of minute amounts of Uranium. The colour of the solution varies greatly with the acid concentration and the maximum colouration is produced at pH range 6.6 to 7.2, The maximum absorption of the colour is in the violet region. Using a constant concentration of the reagent, the colour intensity is found to follow Beer's Law between concentration limits 0.5 to 150 p.p.m., when examined in Spekker Photo-electric Absorptiometer using a violet filter Sensitivity is $2\gamma$; D=5·7,

By potentiometric titration it has been found that Salicylamide forms a simple compound with Uranyl ion having the formula, $UO_2\ (C_6H_4{\cdot}O.\ CONH_2)$.

### 22. Chromatographic Separation and Estimation of Tocopherol in Arachis oil.

MANIK LAL SEN GUPTA and ANIL KUMAR GANGULY, Calcutta

The estimation of tocopherols incorporated or present in vegetable oils is frequently necessary. It has been observed previously that the Emmeric-Engel method can not be directly applied to oils and also that Kaunitz-Beaver's proposed inhibition correction is inadequate to give correct value for the amount of tocopherol in presence of peroxides in the oil. The other likely interfering constituents in the oil like pigments, steroids etc. appear to be of less importance in presence of peroxides. Hence for the estimation of tocopherol, the peroxides require to be removed first and if possible unsaponifiable fraction. Activated alumina has been found to be a very efficient adsorbent in the removal of peroxides and the others from the oil. With this adsorbent a chromatographic method has been developed for the separation of tocopherol with the pure glycerides from the peroxides pigments, free fatty acids and most of the other unsaponifiable constituents of the oil Conditions for the quantitative recovery of tocopherol from alumina column by petrolether 60°—80° for the estimation has been worked out Inadequacy of the existing methods for the estimation of tocopherol in presence of peroxides have been pointed out

### 23. Paper Chromatography of Fruit Juices.

H. C. SRIVASTAVA, (Indian Institute of Sugar Technology), Kanpur.

Fruit juices of orange *(Citrus Aurantium)*, sweet lemon (musammi ), pomegranate *(Punica granatum, Anar)*, black-plum *(Eugenia jambolana,* jaman*)*, melon (ucumis melo-Kanpur variety), mango *(Mangifera indica)*—pulpy (Dashehri) and juicy varieties, lichi *(Litchi chinensis)*, falsa *(Grewia asiatica)* and ripe jack-fruit (*Artocarpus integrifolia*) have been examined and the sugars present in them have been identified paper chromatographically. Glucose, fructose and maltose have been found to occur in almost all these juices. In mango-pulpy variety (Dashehri) however, glucose has been found to be totally absent. Sucrose, excepting pomegranate, falsa and black plum, is present in all of them.

A reducing oligosaccharide has been detected in the falsa juice. It has been isolated and attempts have been made to identify it.

### 24. Paper Chromatography of Alkali Sulphates and Chlorides.

R. VISWANATHAN, Mandapam.

An inexpensive unit has been assembled for paper chromatography of alkali sulphates and chlorides by the one-dimensional, ascending capillary method Methods have been described for the detection (on the chromatogram) of sulphate and chloride, using lead acetate and silver iodate respectively. The chlorides of sodium, potassium and ammonium have been identified in a mixture of the three chlorides while no separation of the sulphates of sodium and potassium could be observed under analogous conditions The usefulness of the chromatographic technique in the microestimation of alkali metals has been discussed.

## INORGANIC CHEMISTRY.

### 25. α—Picoline complexes of Zinc, Cadmium, Cobalt and Nickel.

G. C. BHATTACHARYA and P. C. SINHA, Patna.

α—picoline complexes of Zinc, Cadmium, Cobalt and Nickel have been prepared. They have the formulae

$ZnSO_4$, 1 Pico. $5H_2O$; $CdSO_4$. 2 Pico. $2H_2O$ and $NiSO_4$. 2 Pico

### 26. Studies on Thorium Oxalate.

MONISHA BOSE and DHIRENDRA MOHAN CHOWDHURY, Calcutta.

In the present work the system Thorium nitrate-Potassium oxalate has been investigated by a number of physico-chemical methods viz. thermometry, cryoscopy etc. with the object of determining thet existence and stability ranges of the different complex ions formed. Thermometric titrations have revealed unambiguously the existence of $[Th(c_2o_4)_4]^{-4}$ at all concentration ranges. The presence of $[Th_2(c_2o_4)_5]^{-2}$ ion however is indicated in dilute solutions only. Cryoscopic titrations in $KNO_3$-ice eutectic medium also corroborate the existence of the above two complex ions. As regards the $[Th(c_2o_4)_4]^{-4}$ ion, a systematic investigation revealed that Thorium: Oxalate equal to 1: 8 is a critical ratio for the stability of the complex, above which it is stabilized and remains in solution and below which it suffers hydrolytic decomposition thus satisfactorily accounting for the additional break at $Th^{+4}$: Oxalate equal to 1:8 in the cryoscopic titration curves.

The instability constant of the complex $[Th(c_2o_4)_4]^{-4}$ ion has been determined from the $p_H$ at the begining of precipitation.

### 27. Formation and Stability of Copper and Nickel Complexes of Diglycylethylenediamine.

AMIYA KUMAR CHAKRABURTTY and PRIYADARANJAN RAY, Calcutta.

The formation and stability of the coloured complexes of the quadridentate ligand diglycylethylenediamine with copper (II) and nickel (II), determined previously by the present authors have now been studied absorptiometrically, noting the maximum absorption of the complexes formed at different $p_H$ range.

The reaction constants have been determined graphically by plotting the $p_H$ values against the respective optical densities found, and extrapolating from the $p_H$ value at the mean optical density of any particular stage of the reaction, on the assumption that at the mean position the reactants and the resultants are equal.

The constants have also been calculated following J. C. Gage (J. C. S; 1949,221) who determined the acid dissociation constants of biguanide and some substituted biguanide and some substituted biguanides from the ultra-violet absorption at different $p_H$ ranges, according to the equation.

$$pK = pH \quad \log E''-E/E-E'$$

where E'' and E' are respectively the maximum absorption of the resultants and reactants and E any other value between the two.

The results obtained from the absorption studies are found to tally fairly with those previously determined by the $p_H$-titration as is evident from the comparative table given below :

| | $pK_A$ (formation const.) | | pK (instability const) | |
|---|---|---|---|---|
| | abs. | pH | abs. | pH |
| copper | 7.9 | 7.75 | 8.08 | 7.97 |
| nickel | 10.52 | 10.43 | 5.46 | 5.29 |

### 28. On the oxidation of red phosphorus.

G. S. DESHMUKH and M. VENUGOPALAN, Banaras,

In continuation of earlier work on the oxidation of red phosphorus by potassium bromate and ceric sulphate—the utility of other powerful oxidizing agents *e.g.*, $KClO_3$, $KIO_4$ and potassium persulphate is being investigated. Each of the above oxidant when added to a suspension of phosphorus in acid medium dissolves it gradually. The stoicheiometric relation between P and the oxidizing agent consumed during this process has not yet been successfully established Detailed work with $VIO_4$ is now in progress.

### 29. Molybdenum Corbonitride.

S. P. GHOSH, Patna.

A ternary alloy containing molybdenum, nitrogen and carbon has been prepared by carburising the $\gamma$-molybdenum nitride at 700°C with carbon monoxide It has been shown to be an interstitial solid solution by X-ray analysis. This has been concluded from the change of lattice parameters.

### 30. Complex compounds of Copper and Nickel with Phenyl Methyl Biguanide.

S. P. GHOSH and A. K. CHATTERJEE, Patna

Different modifications of four covalent copper and nickel complexes are known It was expected because of the so called "size factor" that phenyl methyl biguanide complexes will exhibit such modifications. Only one type of complexes have, however, been actually obtained. Besides copper and nickel phenyl methyl biguanidinium hydroxides, a number of other salts, namely, sulphate, chloride, bromide, iodine and nitrite have been described. The complexes appeared to be less stable than the analogous complexes with biguanide.

### 31. On the Double Film Theory of Passivity of Iron and Stainless Steel in Nitric Acid.

R P. KHERA, Hoshiarpur and R. PARSHAD, New Delhi.

By studying the potential-transients of iron in nitric acid, Parshad and Verman have suggested a theory by which the passivity of iron in the acid is due to a double film of Hydrogen-oxygen formed on the metal in the acid.

This paper reports two series of investigations. In the first series, transient potentials of stainless steel in nitric acid are reported. According to the oscillograms of the potential transients the building up of the double film is more marked on stainless steel than it is on iron. In the second series attempts have been made to form artificial double-films of hydrogen-oxygen on various metals

The potential measurements indicate the formation of double films on metals like iron, stainless steel, nickel and aluminium but not on copper. The former list of metal specimens having double film on them become more passive than their counterparts having no or only one film on them.

The hydrogen films were formed by exposure of metals to electric discharge in hydrogen, heating in hydrogen or cathodic electrolytic treatment. The oxygen films were formed by exposure of the metals to air or by giving them anodic electrolytic treatment.

The different experimental facts support the double film theory of passivity.

### 32. "Germanium in Singareni Coal."

T. L. NARASIMHA RAO, Hyderabad, Dn.

Mukherjee and Dutta examined the ashes of different Indian coals spectroscopically and reported that the ashes of Singareni coal contain Germanium. In this paper, the presence of Germanium in the coal has been confirmed by chemical methods. The hydrogen-selenide test was employed.

Iron pyrites is found associated with Singareni coal. As Germanium occurs in coal either as sulphide or as oxide, it was considered possible that the pyrites would also yield germanium. No germanium was however, detected in the pyrites.

### 33. Structure of Felspar.

ESHWAR RAJ SAXENA and D. S. DATAR, Hyderabad Deccan,

The structure of felspar molecule, based on the experimental data obtained by the authors, is given. It is in accordance with the X-ray study and may be represented by a formula

### 34. Studies in the Formation of Complex Mercuric Sulphides.

DAMRI SINGH and P. GOVINDANKUTTY MENON, Banaras.

The colour changes observed during the precipitation of HgS in aqueous solutions may be attributed to complex-formation. The $HgCl_2$ — $H_2S$ and $HgCl_2$ — $Na_2S$ systems have been studied by conductivity, density and viscosity measurements The occurrence of breaks in conductivity —, density —, and viscosity — composition curves indicates the formation of the molecular complexes HgS. $H_2S$ and HgS $Na_2S$. Similar results have also been obtained by taking HgS suspension instead of $HgCl_2$ solution in the above systems.

Investigations are being carried out at present to study (a) the variation in the physico-chemical properties of the above systems with time and with temperature and (b) the complex-formation between HgS and other soluble sulphides.

## PHYSICAL CHEMISTRY

### 35. Reduction Process at the Dropping mercury electrode in pulsating fields: Zinc ion.

H. P. AGARWAL, Kanpur.

The behaviour of Zinc ion in pulsating field has been studied by a modified technique similar to that of Breyer and Gutman's using the oscillograph for measuring the alternating current and extending the measurements to frequencies from 12.5 to 600 cycles per sec. of the a.c. field. The results confirm that the electrode process involving discharge of zinc ions is very slow and so it is unable to keep pace with the a.c. field at high frequency which accounts for the disappearances of B. G. maximum at frequencies as high as 600 cycles per sec. and above.

### 36. Positive Joshi Effect in organic Vapours—Variation with Frequency and Intensity of X-Rays.

G. V. ASOLKAR, Nagpur.

**The potential variation of *positive* Joshi Effect (+ $\Delta$ i) in organic vapours under X-rays has been reported earlier (*Proc. Ind. Sci, Congr, Chem,* Sec., 1951 abs. No, 69, 70; *ibid,* 1952 abs. No, 71), The present investigation reports the influence of frequency and intensity of the X-rays on *positive* Joshi Effect, in various organic vapours *e.g.,* benzene, toluene, xylene, cyclohezane, $CCl_4$, ethyl alcohol etc. The results show that the +$\Delta$ i obtained below Vm the threshold potential, initially increases rapidly with the increase in intensity I of the X-rays,**

reaches a peak value, and then decreases slowly, Thus in benzene vapour at exciting potential 7.96 kV and 23.2 kilovolts anode voltage + 250 % *positive* Joshi Effect at intensity 0.5 mA (anode current) increases to 300 % at 1.0 mA. declining to 25 % at 6 mA. With the available intensity of the X-rays there was no reversal of $+ \Delta i \rightarrow \Delta i$ in benzene vapour. However, with $CCl_4$, cyclohezane and xylene vapour, *ceteris paridus*, with increase in intensity of X-rays, a reversible inversion of $+ \Delta i \rightarrow \Delta i$ was obtained. Thus in the case of cyclohexane vapour 200 % i at 0.5 mA decreased to + 14.3 % at 5 mA and --14.3 % at 6 mA anode current.

The rsults of the variation of $+ \Delta i$ with frequency of X-rays are similar to those of intensity variation. Thus, in benzene vapour at 7.96 kV exciting potential and 3 mA anode current $+ \Delta i$ changed from + 100 % at 10.8 kilovolts (anode voltage) to a maximum + 250 % at 23.2 kilovolts, then declined to + 80 % at 29.4 kilovolts. At potentials close to Vm an initial increase in $+ \Delta i$, a maximisation followed by a decrease and even a reversible inversion to — i has been recorded in $CCl_4$, cyclohexane and p-xylene under ozoniser discharges with increasing frequence (hardness) of X-rays within the range 10.8 — 32.5 kilovolts ganode voltage. Thus in the case of CCl4 vapour + 62.7 % i at 10.8 kilovolts attained a peak value of 81.3 % at 17.0 kilovolts and decreased to + 32.7 % at 26.3 kilovolts changing sign giving —6.5 % at 32.5 kilovolts.

Essentially similar results are obtained with the vapours excited in sleeve tubes, semi-ozonisers, and Maze counter type discharge tube.

The results are explained on an extension of the Joshi's theory to the role of positive ionic space charge. The $\Delta i$ has been shown to be distinctive from the more photoelectric ionization The action of irradiation below Vm is two fold (i) supply of trigger electrons initiating the discharge giving *positive effect* (ii) once the discharge is initiated a partial suppression of current *(negative effect)* due to ionic space charges. *This simultaneous double action of light* explains maximisation of $+ \Delta i$ with optimum I and $\nu$ (Frequency) as also its transition to $-- \Delta i$ at potentials close to Vm.

### 37. Studies on Hydrated Ferric Oxide, Part I. Peptisation by Hydrochloric Acid.

R. C. BANERJI and S. GHOSH, Allahabad,

The paper describes the preparation and properties of colloidal ferric oxide solutions, obtained by the peptisation of precipitated hydrated ferric oxide of different age, by hydrochloric acid, in order to throw light on the variation of the properties of the hydrous oxide with age.

It has been found that during dialysis, ferric ions exuded out for a longer period from the dialysing bag, in the case of sols obtained from the fresh precipitate, whereas chloride was retained more firmly by the colloids from the aged samples.

Osmosis was large in the case of the sols with fresh samples, especially when larger concentrations of acid was used for peptisation. These together with electrical conductivity measurements and the variation in colour of the hydrosols, indicate that the colloid particles are smallest in the samples obtained from fresh precipitate, whilst the particles are bigger in the sols from aged samples. Different coloured sols varying from port-wine and transparent to brownish red with an opalescence can be obtained by regulating the age of the hydrous oxide and the concentration of the acid.

Further, purer and more concentrated sols can be obtained either by the use of smaller concentrations of the peptising acids, or with aged samples of the hydrous oxide. Decrease in the adsorptive capacity of the colloidal particles has also been inferred from electrical conductivity studies.

## 38. Influence of 'ageing' under discharge and an external magnetic field on *Joshi Effect* in iodine.

RAM BHAROS and M. V. RAMANAMURTI, Banaras.

Studies of the role of 'ageing' and of applied magnetic field in the production of *Joshi Effect* ($\Delta i$) in iodine excited in *long used* ozonizers, have been made. The ozonizers were excited by 50 ~ potentials (0.2 to 2.5 kV), and were subjected to an external magnetic field (H) varied in the range 200 — 1000 gauss.

Threshold potential, $V_m$ decreased due to irradiation of ozonizer and 'ageing'. It increased, however, on application of H; the increase is more marked at larger values of H. Discharge current, $i_D$ at $V > V_m$ is decreased both by irradiation and by a magnetic field. $+\Delta i$ (at $V < V_m$) and $-\Delta i$ (at $V > V_m$) are observed in iodine. 'Ageing' favoured $i$ while magnetic field inhibited it. The inhibition in $\Delta i$ is larger with increased H.

Magnetic analogue of Joshi Effect ($\Delta i_H$): The change in $i_D$ due to magnetic field ($\Delta i_H$) is similar to *Joshi Effect* ($\Delta i_{light}$). Like *Joshi Effect* ($\Delta i_H$) is negative at $V > V_m$, is maximum numerically near $V_m$ and decreased with increase of V. ($\Delta i_{light}$) and ($\Delta i_H$) increased with increase of intensity of light and strength of magnetic field respectively.

## 39. Influence of Ageing on Joshi Effect in Argon Contaminated with Mercury Vapour.

M. G. BHATEWDEKAO, D. K. MAJUMDAR and N. A. RAMAIAH, Banaras.

An appreciable negative Joshi Effect corresponding to 80 %. current suppression under light in Argon contaminated with Mercury vapour was observed by the authors for the first time ; the present paper reports a few important findings noted during the studies of the influence of ageing on $\Delta i$ observed therein. Freshly prepared Siemens' type ozonisers pre-degassed) containing A (p = 32 mm. Hg.) and Hg vapour were exposed to discharge due to a fixed V 490 ( $V_m$ 330 volts) and the variation of the current $i$ and the associated $\Delta i$ was noted at regular intervals of time. Unlike in other systems, $Cl_2$, $O_2$, $H_2O$ etc., $i$ and $\Delta i$ were uneffected by ageing. This last was attributed to produce some surface changes *e.g.* the formation of adsorbed layers or/and surface compounds in $Cl_2$ etc. The present observation suggested that $\Delta i$ detected in A + Hg. was presumably not linked with the above surface changes.

### 40. A study of the Viscosity of the System Sodium Laurate-water and Different Alcohols in Presence of Sodium Chloride.

A. N. BOSE and A. C. CHATTERJI, Lucknow,

Viscosity of the system: water-sodium laurate and different alcohols, with varying concentration of alcohol has been studied at different temperatures. It has been observed that the behaviour of this system is different from that of water-sodium oleate and different alcohols. The results have been explained on the basis of the fact that the length of the sodium laurate chain is shorter than the sodium oleate.

### 41. Variation of Electrical Conductance with Temperature and Concentration of the System Water-Sodium Stearate and Different alcohols.

A. C. CHATTERJI and A. N. BOSE, Lucknow.

The specific conductivity of the system water-sodium stearate and different alcohols have been studied. The formation of gel in the case of methyl, isopropyl and amyl alcohols has been explained from the conductivity results obtained for these alcohols.

### 42. Variation of Electrical Conductance with Temperature and Concentration of the System Water-Sodium Laurate and Different Alcohols.

A N. BOSE and C. S. PANDE, Lucknow.

Electrical conductivity of the system water-sodium laurate and different alcohols in presence of sodium chloride has been studied at different concentrations and temperature. The results have been explained on the basis of the hypothesis that the alcohol molecules arrange themselves in between the pakisadal layers of the laurate molecules with their OH group towards the water layer.

### 43. A Study of Viscosity of the system water-sodium stearate and different Alcohols in Presence of Sodium Chloride.

A. N. BOSE, A. C. CHATTERJI, Lucknow,

Viscosity of the system water, sodium stearate and different alcohols has been studied. It has been found that it behaves as oleate system.

Sodium stearate forms gels in presence of methyl, iso-propyl and amyl alcohol at room temperature.

### 44. Mechanism of Chromic Acid Oxidations.

A. C. CHATTERJI and V. ANTONY.

*Part I. Order of reaction of oxidation of alcohols.*

A. C. CHATTERJI and V. ANTONY,

The oxidation of Di-Ethyl carbinol by chromic acid in acid solution has been studied at a definite ionic strength. It has been found that the order of the reaction is one with respect to chromic acid, one with respect to Di-Ethyl carbinol and one with respect $H^+$ ion at low acid concentrations and two at high acid with respect to $H^+$ ion concentrations

### 45. Effect on Foreign Substances on the Release of Supersaturation.

A. C. CHATTERJI and J. P. MATHUR, Lucknow.

Effect of capillary active alcohols, acids and acetone etc. on the limits of supersaturation of Potassium Nitrate, has been studied. All these appear to have the general tendency of decreasing the limits of supersaturation; the higher members of alcohols and fatty acids being more capillary active, produce correspondingly greater decrease in limits of supersaturation than the lower members, at the same concentrations. Certain Inorganic substances seem to produce no effect on the release of supersaturation Dyes also do not have any effect probably because they are wetted complctly by water.

### 46. A study of Metallic Electrodes :—Uniformity of the Silver Electrodes Prepared by Various Methods.

A. C. CHATTERJI and KEDRA SINGH, Lucknow.

From the study of the E.M.F. of silver electrodes, prepared by various methods, in AgNO3 solution of different concentrations it appears that E.M.F. developed between two similar electrodes dipped in the same solution of $AgNO_3$ depends not only on the methods of preparation of the electrodes but also on the concentration of the solution in which these are dipped and on the time lapsed after immersion. The short-circuiting of electrodes, having a potential difference between them in the same solution of $AgNO_3$, certainly lowers the potential difference, but this lowering depends on the concentration of the electrolyte in solution, *i.e.* greater the concentration of the electrolyte in solution, the lesser will be the time required by the electrodes to attain uniformity and vice-versa.

### 47. Studies on adsorption from non-aqueous solvents Pt. III.

A. C. CHATTERJI and R. D. SRIVASTAVA, (Lucknow),

In this paper work on adsorption has been extended to two other solutes, one Cinnamic acid (polar) and the other Phenanthrene (non-polar). The solvents taken are both polar and non-polar. The differences in the amounts adsorbed from different solvents have been attributed as due to the differences in the internal pressures of the solvents. It has been observed that when both solvent and solute are either polar or non-polar, adsorption of a solute in the same type of solvent increases as the internal pressure increases. When one is polar and the other nonpolar then the adsorption of a polar solute in a non polar solvent increases with decrease in internal pressure and of a non-polar solute decreases with the decrease in the internal pressure. Adsorption of a non-polar solute in a polar solvent goes on increasing as the internal pressure increases but of a polar solute in a non-polar solvent first decreases and then again increases.

### 48. Durability of Soda-lime-Silicate Glass. Part VIII, (Influence of adsorbed ions on chemical durability).

H. N. DAS-GUPTA, Dhanbad, and S K. CHATTERJEE, Calcutta.

Base exchange is a typical property of soad-lime-silicate glasses. It has, however, been found that when glass, in the form of powder is treated with a solution of a salt of a multivalent ion, two types of adsorption takes place successively. At the initial stage foreign cations in solutions are adsorbed at the freshly fractured unsaturated surfaces. As no alkali can be detected in the solution, the phenomenon cannot be classed as exchange adsorption. The phenomenon appear to be similar to adsorption of a salt having an ion in common with the lattice. The duration involved in such a type of adsorption appears to be very small and in no case exceeds fifteen minutes. This is immediately followed by exchange adsorption, the concentration of the replaced ions depends on the valency of the adsorbed ions and on duration. The cations adsorbed at the initial stage appear to confer increased durability on glass. Experiments, embracing the influence of different cations on chemical durability of glass, go to show that for conferring increased durability the specific nature of the adsorbed ions are very important, the order of superiority appears to be as follows : U > Ba > Cu > Co > Ni > Fe > Mn > Cr. The power of conferring increased durability by different cations also depends on their counter ions. The order seems to be as follows : Sulphate > Chloride > Nitrate > acetate.

### 49. Conductivity of Lithium Nitrate in mixtures of methyl and ethyl alcohols.

D. S. DATAR and M. A. WAHEED, Hyderabad (Dn).

The conductivity of electrolytes in mixed solvents depends upon (1) the number of ions in association with the different solvents and (2) the mobility of these ions. As the mobility of the ions in the case of methyl and ethyl alcohol mixtures is presumably the same as that in individual alcohols, only the first factor is operative in determining the conductivity in alcohol mixtures.

The calculated values at a particular concentration, according to the formula $\Lambda$ mixture $= \Lambda_e V_e + \Lambda_m V_m$ (where $\Lambda_e$ and $V_m$ are the equivalent conductivities at the same concentration, in pure ethyl and methyl alcohols respectively, and $V_e$ and $V_m$ the volumetric fractions of the respective alcohols in the mixture) closely agree with those observed experimentally by J. Lo Whitman and S. R. Spencer (J. Amer Chem. Sec, 1928, 50, 1840).

### 50. Kinetics of Inactivation of Invertase.

K. S. G' DOSS and H, C, SARASWAT, Kanpur,

A detailed study has been made of the kinetics of inactivation of invertase at 25°C in acid media. It is found that at $p_H$ values lower than 1.34 the inactivation is practically complete in 5 minutes and above $p_H$ 3.0 there is practically no inactivation. From $p_H$ 3.0 to $p_H$ 1.78 there is a certain amount of inactivation within first 5 minutes after which there is no further inactivation. At $p_H$ values 1.4 to 1.6 there is a progressive inactivation with time. The results indicate the existence of two processes, one of them being very fast and coming up at comparatively high $p_H$ values and the other coming up at lower $p_H$ values.

### 51. Behaviour of dilute Acids and Alkalis towards Gelatine Solutions.

J. C. GHOSH and B. P, GYANI, Patna,

The combination of a number of dilute acids (HCl, $CH_2Cl.COOH$, and $H_2SO_4$) and alkalis (NaOH and KOH) with gelatine at different temperatures has been studied. Positive quantities of alkali are taken up by gelatine. The presence of gelatine, on the other hand, increases the apparent concentration of acids in dilute solutions. Both these processes appear to correspond to sorption, and the temperature coefficients in each case are negative as expected for sorportion. NaOH gives Type II isotherms, while sorption isotherms for KOH correspond more to Type I.

### 52, Sorption of Water Vapour on Gelatine.

J. C GHOSH and B P, GYANI, Patna,

Measurements on the viscosity of gelatine in aqueous solutions and the behavour towards solutions of acids point out that the colloid takes up water from the liquid phase by a process of sorption. This conclusion is strongly supported by the behaviour of gelatine towards water vapour The sorption and desorption isotherms have been obtained at 15°, 25°, and 35° A wide hysteresis is observed which starts at low pressures (below 1 mm mercury). The isosteric heat curves are also strongly characteristic of sorption.

### 53. Viscosity of Glucose, Urea, Gum Acacia and Gelatine Solutions and some Properties of the dissolved particles.

. C GHOSH and B. P. GYANI, Patna.

Viscosity of glucose, urea, gum acacia and gelatine in aqueous solutions has been measured at different concentrations both by Scarpa's and Ostwald's methods. The partial specific volume $\phi$ and the shape factor a' for the different dissolved particles have been calculated according to the procedure adopted by Sakurada. It is found that only gelatine at the iso-electric point gives steady values of $\phi$ and at These values change with concentration in other cases, and the change is particularly anomalous in the cases of normal gelatine and arabic acid.

### 54. Effect of $p_H$ on the Behaviour of Bromocresol Purple on the Dropping Mercury Electrode.

S. L. GUPTA, Kanpur.

A detailed study of the behaviour of bromocresol purple at the dropping mercury electrode has been made in indifferent electrolytes of $p_H$ 5.5 and 10.2. It is found that the desorption potential shifts to lower cathodic potential as the $p_H$ is lowered. The factors affecting the desorption potential are discussed.

### 55. Effect of Physical and Chemical Treatments on the Sorptive Properties of *Cicer Arictinum*.

B. P. GYANI, Patna

The sorptive properties of gram powder *(cicer arietinum)* under various conditions in respect of water sorption from the vapour phase have been studied. The powder has been separately extracted with dilute alkali and toluene, and also subjected to evacuation and heating at different temperatures, and under different conditions. As far as water sorption is concerned there is hardly any difference whether one extracts the powder with dilute alkali or toluene. These samples, however, differ in their behaviour towards toluene vapour The untreated powder has the same sorption whether it is evacuated at 55° or 100° (either in the dry or after heating in contact with excess water), but the sorption is greatly increased by treatment with dilute alkali or toluene.

These experiments lead to the conclusion that the temperature of evacuation has no effect on sorption within certain limits. Alkali and toluene extraction probably enhance the sorption by removing fatty matter from the powder, but at the same time some other changes are produced which cannot be detected in the sorption of water, but lead to quite different isotherms for toluene for the two samples.

### 56. Internal Pressures of Liquid Inert Elements and their Heats and Entropies of Evaporation.

B. P. GYANI, Patna.

The latent heats of evaporation at constant pressure and constant volume, $L_p$ and $L_V$ respectively, have been calculated from the vapour pressure-temperature data for liquid inert elements. Internal pressures, $P_i$ have been calculated from $P_i = L_V / V$. $P_i$ is by no means constant but increases as the atomic weight increases. $L_p$ and $L_V$ increase in the same way as also does the entropy of of evaporation at the normal boiling point. Trouton's rule which requires the quantity to be constant and equal to about 22, fails, the actual values calculated increasing from 7.3 for helium to 1.9 for radon.

### 57. Internal Pressures, Free Volumes, and Entropies of Evaporation of some Liquids.

B. P. GYANI, and S. N, DAS, Patna,

Internal pressures and entropies of a large number of liquids have been calculated from their vapour pressure data. The internal pressures tend to increase with increasing unsaturation, and also when polar groups are introduced. A general expression for the entropies of evaporation of a liquid has been deduced, starting from the vapour pressure equation of Van der Waals, $Lp/T = 2.303 R(k + \text{long } p_c/p)$. A consideration of this equation shows that no actual condition can be prescribed such as done by Trouton or Hildebrand, under which $L_p/T$ should be a constant even for non-associated liquids. Free volumes of liquids have been calculated on the basis of Batschinski's equation. The effect of constitution on each of the properties calculated has been discussed.

### 58. Solubility of some nitrates and nature of solution.

B. P. GYANI and Miss RANI MISRA, Patna.

The heat and entropy of solution of some nitrates in water have been calculated from the variations in solubility with temperature. These quantities are found to be quite specific and their magnitudes are not such in general that one can regard the process of solution as sublimation of the salt into the bulk of the solvent. These two quantities also show considerable temperature variation so that it is unlikely that purely physical forces (van der Waals forces) may be involved in the process of solution. These observations may be explained on the view that the presence of salts affects the extent of transitory crystallisation of the solvent as envisaged in the theory of liquids due to Bernal and others.

### 59. A Potentiometric Study of the Double Salts.

S. K. K, JATKAR and M. P, S. AGNY.

The oxidation-reduction potentials of the metallic ions Cu, Ag, Pb, Fe, Co, Ni, Mg, Sr, Ca, Ba, Al and Cr have been measured in the presence of varying proportions ot ammonium ions by making use of the following electrode system.

$$\text{Pt / Solution / sat. KCI. / 1N KCI. } Hg_2Cl_2 \text{ / Hg}$$

The results are graphically shown by the e.m.f. against the c.cs. and dE/dc.c. against mean o.cs. curves.

The results show striking changes in the redox potentials at stoichiometric proportions of the added salts. These changes correspond to the compounds of the general formula $M (NH_4) X$ where M = metal ion and X = 0.5, 1, 1.5, 2, ---------------, 8, 27, 64, 125 and 216. In the direct titrations the intensities of the peaks show a gradual gradation and in the reverse titrations the peaks seem to be prominent at the ratios of $6^3$, $5^3$, $4^3$, $3^3$ and $2^3$.

Some of the peaks at lower ratios correspond to the addition compounds known in the solid state.

A plausible explanation has been put forth to account for the sudden changes in the potentials on the basis of regular grouping of ions in solution

**corresponding to that in the solid state. The results indicate the formation of a cubic lattice in solution.**

**The plots of the observed peak intensities against the calculated values of log $^1/_{r}{}^2$ show a straight line relationship, thus confirming the idea of interionic attraction theory.**

### 60. Dielectric Constant of Liquids and Dipole Moment.

#### *Part I—Organic Halides.*

S. K. K. JATKAR and C. M. Deshpande,

The dielectric constant, density and refractive index of Chlorobenzene and Trichloroethylene in pure liquid state have been measured over a range of temperature. The application of the new equation gives a moment of 1.34, which is independent of temperature, for chlorobenzene in pure liquid state. The Onsager equation gives higher values which indicate a variation with temperature. The new equation gives practically identical values for chlobenzene in liquid state and in solution. These values are, however, lower than the vapour value of chlorobenzene viz. 1.69-1.72. The moments are explained in terms of the resonance structures for the compound.

The moment of 0.76 for liquid trichloroethylene, obtained by the use of the new equation, is independent of temperature. Recalculation by the use of the new equation of previous data for solution gives a value of 0.74 comparable with the value in the liquid state. The moment of trichloroethylene is calculated theoretically on the basis of the method suggested by the authors. The value obtained is 0.84 which compares favourably with the value in the liquid state and that in solution.

### 61. Dielectric Constant of Liquids and Dipole Moment.

#### *Part II—Ethers.*

S. K. K. JATKAR and C. M. Deshpande,

The dielectric constant, density and refractive index of Methyl Cresyl ethers in pure liquid state have been measured over a range of temperature. The moments calculated by applying the new equation are 1.00 for methyl-o-cresyl ether, 1.08 for methyl m-cresyl ether and 1.18 for methyl-p-cresyl ether. These values are practically constant over the range of temperature investigated and compare well with the values calculated theoretically by the method suggested by the authors. The moments of dimethyl ether, diethyl ether, anisole, and diphenyl ether are calculated by the new method. The values obtained compare well with the vapour values and also liquid valus calculated by the new equation. The value calculated by the use of Onsager equation are consistently higher.

### 62. Potentiometric Study of the Precipitation of Aluminium Salts by Alkalies and Soaps

S. K. K. JATKAR and K. A. KHASGIWALE, Poona.

The precipitation reactions of aluminium salts by NaOH and $(NH_4)OH$, have been studied by pointwise potentiometric titration, with calomel half cell and antimony and platinum, as indicator electrodes. A general scheme of the precipitation has been found to be $M(H_2O)_n$ --- $M^{z-1}$ $(OH)$ $(H_2O)_{n-1}$ ---- $M^{z-2}$ $(OH)_2$ $(H_2O)_{n-2}$ -- etc. where M = Metal ion, z = Charge. n = Co-ordination number of the ion. A tentive scheme explaining the structures and formation of the precipitates stepwise, based on the molecular theory has been given.

Aluminium salts when treated with alkali soaps form aluminium soaps of varying stochiometric compositions. The precipitation reaction of aluminium salt by sodium stearte has been studied by pointwise potentiometric titration, using the above electrodes. The results show that due to the hydrolysis of soap solution, most probably, aluminium hydroxide, and stearic acid as a separate phase, are precipitated, instead of proper aluminium stearate.

### 63. Dielectric Constant and Dipole Moment of the Esters of Monocarboxylic Acids.

#### *Part I*

S, K, K, JATKAR and V. K PHANSALKAR,

In the present paper, the dielectric constant, density, and refractive index of pure methyal acetate, ethyl acetate, phenyl acetate and amyl valerinate were measured at different temperatures in pure liquid state. The values of the dipole moment obtained by applying the new equation given by Jatkar are compared with those obtained by Onsager's equation. The dipole moment of methyl acetate is 1.45 D and of ethyl acetate, phenyl acetate, and amyl valerinate is 1.5 D in pure liquids and in solutions. The moments are independent of temperature, concentration and solvent. Onsager's equation gives different moment for different esters and the values are consistently higher than those obtained by new equation. The results are discussed on the basis of resonance structures.

### 64. Temperature Coefficient of Dielectric Constants.

S. K. K. JATKAR and V. K PHANSALKAR.

Numerous attempts have been made to explain the high dielectric constants of pure liquids in terms of the dipole moment. It has been shown in the present paper that the variation of the apparent moment with temperature using the new equation is less than 1/20th and 1/10th of the values calculated by the Onsager and Debye equations. The values obtained from the Kirkwood equation show a variation of the parameter g degree. The new equation involves no parameters, and still takes into account the hindered rotation which is given by $2J + 1 = 2$, showing parallel and anti-parallel orientation in solids and liquids, and $2J + 1 =$ infinity for all orientations in gases.

### 65. Interaction between two Sol particles.

S. D. JHA and S. GHOSH, Delhi and Allahabad.

In this paper the force acting between two sol particles is considered. The force of attraction as shown by Boer is given by $A/r^3$, where A is a constant and r the distance between the particles. The force of repulsion is given by $Be^{-kr}$ The resultant of the attractive and repulsive forces acting between the particles is obtained graphically, both for lyophilic and lyophobic sols. The nature of the resultant and its Characteristic points are obtained by a mathematical analysis also. The points of distinction between lyophilic and lyophobic sol systems follow directly from the mathematical treatment given in this paper.

### 66. Adsorption of Dyes on metallic surfaces.

B. W. KELKAR, K. K. DOLE and D. D. KARVE, Poona.

Adsorption of methyl orange, methylene blue, toluidine blue, bismark brown, brilliant green, neutral red, hematoxylene on platinum and copper plates has been studied. Adsorption coefficient decreases in the decrease in the reactivity of the metal. Repeated adsorption from the same solution shows maximum value and a consequent decrease in the adsorption coefficient, regular increase or decrease in the coefficient, no adsorption or constant value for adsorption coefficient after some observations. These are probably due to adsorption after the hydrolysis of the dye, its osmotic pressure in the solution and solution pressure of the metal which may be changing the nature of the medium after each observation.

In the case of mixed dyes selective adsorption is observed. The bigger molecules of methyl blue or aniline blue do not allow methyl orange to get adsorbed. Selection of the dye by the adsorbent probably depends upon the size of the molecule of the dye and its orientation at the surface of the metal.

### 67. The determination of the temperature coefficient of the catalytic decomposition of potassium chlorate in the presence of the sulphates of chromium, manganese, cobalt and nickel.

G. B. KOLHATKAR and L. M. APTE, Sangli.

Homogeneous mixtures of potassium chlorate and the catalyst are obtained by evaporating the mixtures of their aqueous solutions at 120° in an air bath. The ratio of the catalyst metal to potassium chlorate in the mixtures is 1 : 10.

The mixtures are heated in a bath of melted lead at different temperatures and the liberated oxygen, collected in a eudiometer at definite intervals, is measured. The decomposition of potassium chlorate in the presence of the catalyst is a unimolecular reaction.

| Name of catalyst | chromium. | manganese. | cobalt. | nickel. |
|---|---|---|---|---|
| Range of temperature | 225-235 | 255-265 | 245-255 | 265-275 |
| Temperature coefficient | 1.6 | 2.012 | 1.74 | 2,125 |

### 68. Kinetics of the oxidation of Phosphorus acid by Hypochlorous acid.

G B KOLHATKAR, C. R. TALPADE and D N INAMDAR, Poona.

The kinetics of the oxidation of phosphorus acid by hypochlorous acid has been studied. The main reaction between phosphorus acid and hypochlorous acid is accompanied by a number of consecutive reactions which complicate the course of the reaction. The reaction is, therefore, followed by determining graphically the initial velocity (vo).

On keeping the concentration of one of the reactants constant and varying the concentration of the other reactant, the initial velocity is found to vary with the concentration of the varying factor. The main reaction is retarded with a decrease in $p_H$ value of the reaction mixture. It has been observed that a linear plot is obtained if the reciprocoal of the initial velocity is plotted against the number of Hydrogen ions present in the reaction mixture.

The consecutive reactions can be prevented by the use of sodium acetate as a buffer or by the addition of silver sulphate which removes hydrochloric acid produced in the reaction. In the presence of the esodium acetate or silver sulphate the values of Kbi obtained are fairly constant. Increase in temperature brings about an acceleration in the velocity of the reaction.

### 69. Kinetics of the oxidation of Hypo-phosphorus acid by Hypochlorous acid.

G. B. KOLHATKAR, C. R. TALPADE and D N. INAMDAR, Poona,

The kinetics of the oxidation of hypophosphorus acid by hypochlorous acid has been studied. The reaction velocity is found to be dependent on the concentrations of both the reactants. The reaction velocity is accelerated by a decrease in the $p_H$ value of the reaction mixture. A linear plot is obtained if the values of initial velocity of the reaction are plotted against the number of hydrogen ions present in the reaction mixture. The consecutive reactions which are responsible for complicating the course of the reaction, can be prevented by the use of either sodium acetate or silver sulphate solution which removes the hydrochloric acid produced during the course of the reaction. In the presence of sodium acetate buffer or silver sulphate solution, the values of Kbi obtained are fairly constant. The increase in temperature brings about an acceleration in the reaction volocity.

### 70. Anadic Oxidation of n-propy alcohol.

M. V. KULKARNI and K. K. DOLE, Poona,

The Oxidation of n-propyl alcohol in aqueous sulphuric acid solution is carried out electrolytically in an undivided cell at platinum electrodes. The influence of current density, concentration of alcohol and that of sulphuric acid is studied. Current efficiency with respect to acid formation is found to increase with current density, but no linear reaction is observed. At current density of 0.3900 amp./sq. cm. The current efficiency was 74.27 %. Alcohol concentration above a certain value has little influence on the oxidation. At higher concentrations of sulphuric acid and at higher current densities more ester is formed than at low concentrations of the acid and low current densities.

### 71. Refractometric studies of Glass systems-Platinum dispersed in Lindemann Glass.

SUBODH KUMAR MAJUMDAR, Darjeeling.

The subject of deformation of ions in $B_2O_3$ & $Na_2B_4O_7$--glasses has been investigated by the present author in a large number of papers. In all these investigations, it has been found that polar crystals like alkali halides, sulphates, etc. and noble metals like gold are very strongly deformed in solid solution, as shown by their abnormally low values of mole refraction, R, in the Lorenz-Lorentz equation. The polarising power has been found to obey Fajans' Rule of Deformation (Fajans & Joos, Zeitschrift fur Physik, 1921, *97*, 304). Fajans & Kreidl in recent years have also found the rule to hold good in the case of silicate glasses (Fajans & Kreidl, Journal Amer. Ceramic Soc., 1948, *31*, *4*, 105).

The substances investigated by the present author so far were all diamagnetic and magnetic measurements revealed in every case in abnormal *increase* in the value of their diamagnetic susceptibility when dissolved in glass systems. This can be accounted for by supposing increased orbitals of the electronic paths of the dissolved ions, *i.e.* an enlargement of lattice in glass media. This is at variance with the refractometric data.

In the present paper, the mole refraction of platinum dissolved in Lindemann glass (lithium-beryllium borate glass) at different concentrations up to 2 8 % has been determined and it is found that the value of mole refraction "R" of platinum in the dispersed state, calculated from the Additivity Formula, is much higher than its value in the crystalline state. This goes against the theory of Deformation ; the refractometric data in other cases, on the other hand, support the theory.

Magnetic measurements of platinum dispersed in a similar system, namely borax glass, indicate also decrease in para-magnetic susceptibility of the dispersed platinum. If decrease in para-magnetism is taken to mean an increase of diamagnetism (Van Vleck's theory), this would also point to enlargement of the lattice of the metal in glass media. So, both the magnetic & refractometric data in this case go against the Fajans' Theory of Deformation for such systems. The electrical conductivity of platinum dispersed in borax glass is being studied & some very interesting results have been already found.

### 72. Influence of small amounts of Organic Vapour on Joshi Effect in gases : Part I Air in Ozonizer discharge.

O. P. MALHOTRA, G. S. MITTAL and S. K. SHUKLA, Banaras,

Quenching action in the G. M, counters of polyatomic organic vapours suggested an investigation into their influence on discharge current and the associated Joshi effect in Siemens' type all glass ozonizers filled with air (20-200 mm Hg) and excited by 50 $\sim$ potentials (0.5 — 6.0 kV), Vapours of ethyl alcohol, amyl acetate, ether, petroleum ether (40—60°C), cyclohexane, toluene, benzene, chloroform and carbon tetrachloride were added individually upto 1-1.5 %. The discharge current i (both in dark, $i_D$ and when irradiated $i_L$) decreased to a minimum immediately after the addition ; it, however, recovered (and often exceeded) the original value for pure air with time of exposure to discharge. Essentially same result were obtained with positive Joshi Effect (+ % Δ i) observed at high air pressures; but the recomery of + % Δ i (as also of $i_L$) was more rapid than of $i_D$. Negative Joshi Effect (— % Δ i( showed however a reverse change i.e. on admixture of organic vapour, — % Δ i increased "numerically" to a maximum value followed by a decrease invariably to a value less than that for pure air. The introduction of the organic vapour below Vm caused no sensible change in the latter and the behaviour of the conductcivity and Joshi Effect on starting the discharge, was similar to that reported above.

On continued use with the above vapour the ozonizer was found to have been deactivated with respect to Joshi Effect. Reactivation was, however, achieved by boiling with aqua-regia followed by thorough washing with distilled water.

These findings are explained in the light of Korff's theory of self-quenching —counters and Joshi's theory for the phenomenon Δ i.

### 73. Depolarization Factors of the Transversely Scattered Light During the Slow Cooling and Setting of Sodium Oleate—Nujol Systems.

MATA PRASAD, K. B. DESHAPANDE, and K. P. BUCH, Bombay.

The depolarization factors of the transversely scattered light have been measured during the gelation of sodium oleate in Nujol, using unpolarized, horizontally polarized and vertically polarized incident light. The results obtained for these factors at various temperatures show that the anisotropy and the size of the particles increase during gelation and attain a constant value at some lower temperatures. The final size of the particles in gels of higher concentrations is smaller than that in gels of lower concentrations. However, the final value of anisotropy in gels of higher concentrations is higher than that in gels of lower concentration.

### 74. Magnetic Study of some Double Salts.

MATA PRASAD, D. D KHANOLKAR and K. V. KATTI, Bombay.

Magnetic susceptibilities of a number of chemically pure double salts prepared in this laboratory were measured on a Gouy's magnetic balance with a view to find out the binding between the components of the double salts. The results indicate that the ebinding force is of the nature of Van der Waals' forces.

### 75. Magnetic Study of some Organic Molecular Compounds.

MATA PRASAD, D. D. KHANOLKAR and K. V. KATTI, Bombay,

Study of the structures of picrates, a typical class in which the colour of the molecular compound is deeper than either of the components, has been made by determining the magnetic susceptibilities of pure picrates on a modified form of Gouy's balance. The deviations of the observed values, of molar susceptibilities of the picrates from those computed by adding up the molar susceptibilities of the components have been attributed to the electronic changes taking place on account of the formation of these molecular compounds.

### 76. Magnetic Study of some Ammines.

MATA PRASAD, D. D. KHANOLKAR and P, K, KHOPKAR, Bombay,

Magnetic susceptibilities of some diamagnetic ammines (other than complex ammines) were measured on a modified form of Guoy balance. The $X_M$ per $NH_3$ is found to be lower than the value for liquid liq. ammonia (19.0) in the case of ammines which contain a small number of $NH_3$ molecules. The results indicate a close analogy with the magnetic behaviour of salt hydrates and suggest anion ammination through H bonding between $NH_3$ and the anion. Theoretical calculations by Guoy and Cruichshank's method support this view.

### 77. Magnetic study of some polybasic acids and their hydrates.

MATA PRASAD, D. D. KHANOLKAR and P. K KHOPKAR, Bombay,

The magnetic behaviour of some hydrated polybasic carboxylic acids and their anhydrous forms was investigated by determining their magnetic susceptibilities. It has been shown that as compared with the monobasic fatty acids, the anhydrous polybasic acids appear to be polymerized through linking of carboxylic groups. The links are through H-bonds. The hydration of these acids probably takes place through the carboxyl groups.

### 78. Magnetic Study of Some Homologous Organic Compounds. A relation between the molecular susceptibility and the total number of electrons in the molecule.

MATA PRASAD, L. N. MULAY and D. D. KHANOLKAR, Bombay,

The magnetic susceptibilities of some pure homologous organic compounds were measured on a modified form of Gouy's balance From the results obtained, and from the values of the molecular susceptibilities ($\chi$ m) reported in the literature for aliphatic and aromatic hydrocarbons and compounds containing the functional groups like Cl, —OH, —C:O, —COOH, $-CONH_2$ ; the esters of some mone and dibasic acids, and the heterocylic compounds containing nitrogen, a linear relation has been shown to exist between $\chi$ m and the total number of electrons ($\Sigma$ Z) in them. The linear relationship has been discussed in the light of the Langevin's equation and the Ikenmeyer's relation.

Evidence to show that the value of $\kappa$ $CH_2$ definitely varies with the homologous series has been adduced from the graphs representing the linear relation. This relation may be utilized to calculate the molecular susceptibility of organic compounds in an entirely different way than the one involving the use of Pascal's constants. Further work in this direction is in progress.

### 79. Depolarization Factors of the Transversely Scattered Light During the Slow Cooling and Setting of Sodium Oleate—Xylene Systems.

MATA PRASAD and V. SUNDARAM, Bombay.

The variations in the values of the depolarization factors of the transversely scattered light during the slow cooling of gel-forming systems of sodium oleate in xylene have been investigated The results show that the particles increase in size and anisotropy during cooling and that this increase continues even after the gels have set

### 80. Influence of small amounts of organic vapour on Joshi-Effect in Gases : Part II Iodine in sleeve discharge.

G S. MITAL and O. P. MALHOTRA, Banaras,

Studies of the influence on Joshi-Effect, $\Delta$ i, in iodine on admixture of an organic vapour (viz., (a) ether, (b) amyl acetate, (c) cyclohexane, (d) chloroform, (e) carbon tetrachloride, (f) benzene) were made. Iodine vapour (0.3 mm Hg at 30°C) was excited in glass tubes with external metallic sleeve electrodes by 50 ~ potentials, V 0.4 -- 2.5 kV. Threshold potential, Vm, for pure iodine (*e.g.* 0.44 kV) increased markedly by the addition of (a) — (e); it, however, decreased with (f). current in dark ($i_D$) at a fixed V, decreased from the instant of addition of (a) — (e), to a minimum followed by a slow increase to the original value for pure iodine and occasionally exceeded it With (f) again, only a continuous increase of $i_D$ was observed. Positive Joshi-Effect *increased* markedly by addition of (a), (b), (c) and (f). Numerical value of $-\Delta$ i (also of $\Delta$ i) increased with (d) and (e) instantaneously and also with (b) but after a characteristic time lag (e.g. 8-9 minutes); - $\Delta$i remained unaltered with the rest

### 81. Clay Membrane Electrode for Measurement of Copper Ion Activity.

D K MITRA, Calcutta and B CHATTERJEE, Sibpur

Clay membrane electrodes sensitive to copper ions have been developed by careful evaporation at about 80°C of a 1.5 per cent suspension of $< 2\ \mu$ Calcium clay prepared from a sample of bentonite from Tinpahari. The membranes are cut into size (10 mm. discs), dried at 600°C for 18 hours and finally cemented on the ends of pyrex glass tubing of appropriate size. The potential difference measured between two standard copper chloride solutions, one inside the glass tubing and the other outside, showed excellent agreement with that calculated from the Nernst equation, $E = \frac{RT}{nF} \ln \frac{a_1}{a_2}$, where $a_1$ and $a_2$ are respectively the copper ion activities of the inside and outside solutions. Using a series of copper chloride solutions of known copper ion activities, the electrode has been found to give excellent results in the range 0.000118 — 0.00135 molal copper chloride.

### 82. The Acid Character of Silver Halide Hydrosols.

R. P. MITRA and A. R. GUPTA, Delhi.

Silver halide hydrosols, prepared by the action of silver nitrate on excess HCl and HBr and dialyzed to remove most of the free acid, gave potentiometric titration curves with bases which showed, in addition to features arising from the free acid still present in the system, a pronounced buffer action in the range of $p_H$ 6 — 7, followed by an inflexion. The clear ultrafiltrates of the sols gave similar titration curves and the final inflexion in the curve indicated a total acidity of the ultrafiltrate which was only about 20 % less than that of the sol. The observed buffer action of the sol in the range of $p_H$ 6 – 7 thus appears to be due, in a large measure, to some soluble acidic component. Polarographic study of the ultrafiltrate showed a distinct silver 'wave' and the amount of silver calculated from this wave was much larger than what would be obtained from the solubility product of the silver halide and the known concentration of halide ions present in the system The presence of some soluble complex of silver is indicated. The amount of silver given by the polarographic wave agreed with that part of the acid in the ultrafiltrate which was not due to the free acid contained in it The acidity of the sol. apart from the free acid which it contains, thus seems to be largely due to an acidic silver complex.

### 83. Influence of Gas Pressure and Applied Potential on Joshi Effect in Oxygen under Sleeve Excitation.

S. R. MOHANTY, T. D. PRASADA RAO and R, RAMAIAH, Banaras,

The Joshi effect has been studied in oxygen (10–80 mm Hg, 32°C) in a cylindrical discharge tube with external sleeve electrodes over 3–8 kV (r.m.s.) of 50 cycles. At constant pressure $pO_2$, whilst the net *effect* % $\Delta$ *i* first increases with applied V and then decreases, the relative *effect* % $\Delta$ *i* is maximum near the 'threshold potential' $V_m$ and decreases progressively thereafter. Thus *e.g*, at 31 mm, $\Delta$ *i* at 3.74 kV is 3.47 and increases to 5.01 at 5,34 kV; increase of V to 6,41 kV decreases *i* to 4.73. The relative effect % $\Delta$ *i* is 57.2 at 3,74 kV and decreases to 10.9 at 6.41 kV. At constant V, whereas $\Delta$ *i* increases with $pO_2$ and then decreases, % $\Delta$ *i* increases progressively. Thus, at 5.87 kV $\Delta$ *i* increases from 3.23 at 14 mm to 5.32 at 46 mm, and decreases thereafter to 4.75 at 75 mm; % $\Delta$ *i* increases from 33.6 at 14 mm to 56 at 75 mm. Under condition of constant current-in-dark $i_D$, $\Delta$ *i* (and thereafter % $\Delta$ *i*) increases initially with $pO_2$ and then decreases. Thus *e.g.*, for $i_D$ = 8, $\Delta$ *i* is 3.15, 4.35, 4.6, 4.85 and 4.8 at 14, 31, 46, 60 and 75 mm. respectively,

### 84. Variation with Electrode Length of the Joshi Effect in Oxygen under Sleeve Excitation.

S. R. MOHANTY, R. RAMAIAH and T. D. PRASADA RAO, Banaras,

Variation with electrode length in the range 1-4 cm of the Joshi effect in Oxygen at a constant pressure of 28 mm Hg (31°C) has been studied under sleeve excitation at different potentials varied over 4-7 kV (r.m.s.) of 50 cycles frequency. At constant V, whilst the net *effect* $\Delta$ *i* is maximum for an electrode length of 1.5 cm. the relative *effect* % $\Delta$ *i* is maximum for 3 cm. Thus, values for $\Delta$ $i$ at 5.61 kV for 1.0, 1.6, 2.0, 3.0 and 4.0 cm electrode length are respectively 14.6, 15.72, 12,74, 10.73, and 2,59, the corresponding values of % $\Delta$ $i$ are 70.2, 79.7, 82.8, 86.1 and 64.7, Under conditions of constant current-in-dark $i_D$, the variation with electrode length of $\Delta$ $i$ (and therefore % $\Delta$ $i$) is similar to the variation of % $\Delta$ $i$ at constant V. Thus, for $i_D = 9$, $\Delta$ $i$ values for the above electrode lengths are 4.6, 6.0, 6.8, 7,65 and 6.9 respectively,

### 85. Studies on Gum Jeol (Lannea Grandis, Engler). Interaction of Jeolic Acid with Nonelectrolytes.

S. N. MUKHERJEE, Jadavpur, Calcutta.

Protophilic nonelectrolytes like acetone and ethyl alcohol interact with the Jeolic acid with effects roughly similar to those with neutral salts. Both hydrogen ion activity (aH) and the total titratable acidity (CH) show tendencies towards increase with increasing addition of the nonelectrolytes, the latter reaching maximum values at higher concentrations The maximum reached with acetone is higher than that with ethyl alcohol.

### 86. Formation of Complex Compounds between Mercuric Chloride and Potassium Chloride.

*Part IV. Magnetic Susceptibility.*

M. R. NAYAR and K. V. NAYAR, Lucknow,

The magnetic susceptibility of a series of mixed solutions of mercuric chloride and potassium chloride have been studied using the modified Decker balance designed by Dr. K. N. Mathur (National Physical Laboratories, Delhi.). The solutions were prepared by the method of mono-variation (Parts I, II & III of this series, refer: Abstracts., Indian Science Congress Proceedings 1952.). The values of the susceptibilities obtained were ploted against the varying concentration of mercuric chloride in the series of solutions and the curve obtained showed six definite breaks at points corresponding to the formation of the compounds:

4KCl. $HgCl_2$; 2KCl. $HgCl_2$; 3KCl. $2HgCl_2$; KCl. $HgCl_2$; 2KCl. $3HgCl_2$ & KCl. $2HgCl_2$., respectively.

This result is in exact agreement with the previous ones where the viscosity, refractive index and surface tension of the same series of solutions were studied.

### 87. Rotatory Dispersion of Calcium Salt of Reychler's Acid.

Dr. O. N. PERTI and S. R. K. MURTY, Saugor,

The calcium salt of Reychler's acid was prepared essentially according to the method of Graham (*Trans. Chem. Soc.*, 6912, p, 746), The rotatory dispersion of the anhydrous salt was studied in the visible region of the spectrum. It was found that in water, at a concentration 2.4888 gms./100 ml. and at a temperature of 27°, the dispersion is simple and can be adequately expressed by the equation $\alpha = \frac{5{\cdot}273}{\lambda^2 - 0{\cdot}1169}$ where $\alpha$ is sp. rotation for wave-length $\lambda$. It was also noticed that the anhydrous compound gives slight fluorescence under the impact of X-rays

## 88. Rotatory Dispersion of Strontium Salt of Reychler's Acid.

O. N. PERTI and S. R. K MURTY, Saugor,

The strontium salt of Reychler's acid was prepared by the interaction of the acid and strontium carbonate in a way similar to the preparation of barium salt (*Current Science*, 1952, *21*, 194). The anhydrous salt was obtained by heating it at 125° in an air oven for over 14 hours.

The rotatory dispersion of the anhydrous salt was studied in water at room temperature in the visible region. It was found that in water, at a concentration 2.0176 gms./100 ml. and at a temperature of 29° the dispersion in the visible region can be expressed by the equation $\alpha = \frac{4{\cdot}831}{\lambda^2 - 0{\cdot}1161}$ where $\alpha =$ sp. rotation and $=$ wave-length used.

It was also noted that the anhydrous salt gives an intense fluorescence under the impact of X-rays.

## 89. Effect of Different Ions on the Negative Viscosity of Potassium Iodine Solutions.

SATYA PRAKASH and PREM NATH SAXENA, Allahabad.

The viscosity of potassium iodide solutions, in the region of Negative Viscosity, has been studied in presence of potassium chloride, nitrate, acetate and bromide. The first three are found to increase the viscocsity of potassium iodide solution and bromide lowers it. The order being acetate > nitrate > chloride. The same is cofirmed by using the corresponding acids. The order in this case also is found to be the same. The effect of H ions on the viscosity is certainly towards increasing the viscosity of potassium iodide, so much so that the depression which is noted in case of potassium bromide disappears and the viscosity of potassium iodide increases in presence of hydrobromic acid.

## 90. Influence of Temperature on the Kinetics of Sol-Gel Transformation.

SATYA PRAKASH and PREM NATH SAXENA, Allahabad.

The authors have studied the kinetics of sol-gel transformation with respect to concentration of the coagulating electrolyte and the variation of temperature. They have shown that the equqtion $\log h_c = p.c + A$ is applicable during the period of slow gelation, where p may be said to be dependent on the rate of slow gelation, where p may be said to be dependent on the rate of gelation and A on the characteristic nature of the jelly. The authors have studied the changes in p and A with respect to temperature for ferric phosphate, chromium arsenate, iron borate, ferric arsenate and iron silicate sols. The value of p with temperature depends upon how the temperature affects number of factors, namely, the velocity of coagulation, the surface activity of particles, the hydration tendency, the net work development and the hydrolysis of the substances, and is found to increase with temperature. The value of A which depends upon the characteristic texture of the jelly, should not have changed under ideal conditions but is found to decrease very slightly. This is supposed to be due to the fact that the texture of the jelly is not necessarily the same at higher temperatures.

## 91. Investigation of the Kinetics of the reaction between potassium persulphate and oxalic Acid.

SATYA PRAKASH SRIVASTAVA and S. GHOSH, Allahabad.

The oxidation of oxalate ion by persulphate ion has been found to be very slow at ordinary temperature (25°C) by R. Kempf and by C. V. King, and King has studied the course of this reaction in the presence of Ag ion as a catalyst The author found that his results were not reproducible, but that the reaction is autocatalytic. The present paper deals with the study of the reaction between $K_2S_2O_8$ and Oxalic acid and it is found that the results are fairly reproducible. The following conclusions are arrived at from the study of the kinetics of this reactions : –

(1) The reaction is autocatalytic in nature and its speed becomes significant from 45°C and is greatly affected by temperature.

(2) The reaction is strongly catalysed by both Ag and Cu ions as is common to many reactions of $K_2S_2O_8$. It is also catalysed by both Ag and Cu ions as is common to many reactions of $K_2S_2O_8$. It is also catalysed by $HgCl_2$ and by $H_3O^{\cdot}$ ion.

(3) The effect of ionic strength on the reaction is negative i.e. in the presence of such electrolytes as KCl, $K_2SO_4$ and $AlCl_3$, the velocity decreases.

(4) The existence of induction period as observed in this reaction may be attributed to some extent to the increase of $H_2SO_4$ formed with the progress of the reaction because the presence of $H_2SO_4$ in the reaction mixture from the beginning decreases the induction period only in earlier stages.

(5) The reaction, however, remains always autocatalytic whether it is carried out in the absence or the presence of any catalytic agent.

(6) It is concluded that the autocatalytic nature of this reaction is not due to the formation of an unstable tri-valent Ag ion as suggested by King, for the nature of this reaction remains unaltered in the absence of any catalytic agent as well.

(7) Although the salt effect is negative, yet it is difficult to state exactly the nature of the salt effect involved.

(viz. whether it is primary linear salt effect or primary exponential salt effect, though certainly not secondary salt effect.) This uncertainty is due to the uncertain nature of the order of the reaction, and to a lack of any exact quantitative relationship between the velocity of the reaction and the ionic strength of the medium because of specific action of some ions in this reaction velocity.

(8) The unreproducibility of the results by King is most probably due to the method adopted by him in following the course of the reaction.

### 92. A Review on the Influence of Ageing on Joshi Effect.

N. A. RAMAIAH, M. N. KALE, Banaras and A. P. SAXENA, Indore

Soon after the discovery of the phenomenon $\angle i$, it was observed that ageing, *viz.* continued exposure to discharge due to a fixed $V$, investigated primarily in Siemens' type vessels, increased numerically $\angle i$; the corresponding rate appeared to follow unimolecular law. The time $t$ needed for attainment of maximum $-\Delta i$ depended upon *inter alia* the difference $V - V_m$ *(vide infra)*, and varied from 30 min to 10 hrs; $-\Delta i$ obeyed a power time law. This enhancement of $-\Delta i$ was attributed to some suface changes *e.g.* on Joshi's theory, to the progressive formation of an adsorption-like layer. In view of the markedly rapid rate of sorption under discharge, the long time intervals necessary to produce maximum $-\Delta i$ appeared anomalous.

The initiation of $-\Delta i$ by but ageing or coating materials like KCl in acid-treated vessels and its ready occurrence in those of which the surface alkali was not removed by acid-treatment, suggested that ageing produced certain surface compounds like NaCl in $Cl_2$, NaBr in $Br_2$, NaOH in $H_2O$, etc., by the combination of the discharge products with the constituents of glass, chiefly $Na^+$ ions liberated under discharge at the surface on account of the electrolytic nature of conduction of glass. This was easily possible in soft rather than in hard glass vessels; suggestively enough, influence of ageing was more appreciable in the former than in the latter Below the breakdown potential $V_m$, this electrolytic conduction was minimum; the effect of ageing at $V < V_m$ was negligible. Compound formation under discharge was marked at large $V - V_m$ as also the influence of ageing. Furthermore, under conditions where the production of surface compounds during ageing was inappreciable: thus e.g. at $V$ just near $V_m$ in Siemens ozonisers, or even at $V >> V_m$ in a silica ozoniser and Geissler tubes with Pt electrodes ageing did not increase $-\Delta i$; in fact, inhibited it.

That enhanced $-\Delta i$ during ageing is due to the deposition under discharge of some compounds on the electrode surface, is significant. How these increase numerically $-\Delta i$, is a matter of some theoretical importance and merits further consideration.

### 93. Langmuir Adsorption as a Determinant of Discharge conductivity of a low frequency Electrodeless Discharge.

N. A. RAMAIAH, K. A. RAJU, and M. C. PRATAWADEKAR, Banaras.

Following the observation that thermo and photo electric currents were markedly influenced by the amount of gas adsorbed, detailed investigations on the variation of the discharge current *i* due to adsorption under discharge were undertaken. The present paper reported results in an electronegative gas e.g. $I_2$. Siemens' type all glass full ozonisers were degassed to remove the preadsorbed layers and filled with $I_2$ vapour; they were excited by a fixed $V > V_m$ (50 $\sim$) and the variation of *i* was noticed at invervals of 1 min. *i decreased* markedly rapidly and attained saturation within 12 min. This diminution of *i* with time was attributed to the increase due to sorption under discharge viz. chemisorption, of surface work function $\phi$ which controlled the electronic 'primers.' Increase of $\phi$ with Langmuir adsorption suggested that the atoms adsorbed on the surface retained their electronegativity. The removal of free alkali on the glass surface by washing this last with acid solution altered the data markedly. The significance of this finding was discussed.

### 94. Influence of Applied Potential on the production of pulses in a low frequency Electrodeless Discharge.

N. A. RAMAIAH, N. SUBRAHMANYAM, M. G. BHATAWDEKAR and M. V. R. KRISHNA RAO, Banaras.

Of the two types of pulses observed on the current trace in a low frequency electrodeless discharge, the longer ones (*a*) were attributed to avalanches created by electrons released from the cathode by $\gamma$ and $\gamma - g$ processes, and the shorter pulses (*b*) to the other Townsend $\beta$ mechanisms. External irradiation suppressed (*a*) to give $-\Delta i$; and under definite experimental conditions, initiated or/and increased (*b*) to cause $+\Delta i$. Detailed investigations now made in iodine vapour excited in cylindrical tubes by external sleeve electrodes with V of 50 $\sim$, showed that at $V = V_m$, only pulses of type (*a*) were produced. These were suppressed markedly by external light yielding maximum $-\Delta i$. At increased V, pulses (*b*) were generated due presumably to the predominance of photoionization of gas particles; and (*a*) were inhibited. At $V >> V_m$ pulses (*a*) were absent; only (*b*) were present. The non-occurrence of (*a*) at enhanced V explains the inhibitive influence on $-\Delta i$ of V, a general characteristic of the phenomenon.

The theoretical significance of the differential production of (*a*) and (*b*) at varied fields was discussed.

### 95. Variation of the Nature of Pulses Produced Under Discharge with Mode of Excitation.

N. A. RAMAIAH and K. N. TANTRY, Banaras,

The dependance of the nature of pulses produced under discharge with type of exciting field was investigated by employing a G. M. counter-like semi-ozoniser containing Pt wire sealed axially in a glass tubing and filled with $I_2$ vapour. The discharge tube was excited by 50 cycle and d.c. potentials in the range 1 to 5 K. V. The current *i* due to the two halves of the pulses (10 to 30 Kc/s) was separately measured by employing a l.t. transformer of suitable inductance and a galvanometer, using crystal 1N34 (Sylvinia) as the rectifier. It was noticed that when discharge was maintained by V of 50, current *i* due to one half cycle was roughly equal to that of the other, *i.e.*, the pulses were almost symmetrical in respect of the two halves; when d.c. potentials were applied, the disparity between the two halves of the pulses as manifested by observations of *i*, was marked; thus, e.g., at 2KV (Central wire being + ve), *i* due to one half was $56 \times 10^{-8}$ and that of the other was $4 \times 10^{-8}$ amp.

### 96. Photo-Bromination of Glycerine.

K. V. NARAYAN RAO and A. K BHATTACHARYA, Saugar.

Bromination of glycerine is found out to be a purely photo-chemical reaction. Kinetic measurements are performed, using different concentrations of glycerine and bromine. 1000 watt bulb is used as a light source. The rate of reaction is dependent on both glycerine and bromine concentrations. The velocity constant increases with increasing strength of glycerine and decreasing strength of bromine. Conductivity and $p_H$ measurements are carried out in the elucidation of the mechanism of the reaction A case of autocatalysis is pointed out.

### 97. Reproducibility of the Copper-Copper Thiocyanate Electrodes : Studies in Transport Number of Potassium Thiocyanate and Sodium Thiocyanate So' By E. M. F. and Moving Boundary Methods.

J. N. SAHAY, Ranchi.

A series of measurements with the concentration cell with transport of the type :

$$\text{Cu-CuCNS} \;/\; \underset{(c_1)}{\text{MCNS}} \;/\; \underset{(c_2)}{\text{MCNS}} \;/\; \text{CuCNS-Cu}$$

have been made. The reproducibility of the copper-copper thiocyanate electrode has been studied in considerable detail with different types of cells under various experimental conditions. The electrodes were generally of three types, *viz.*, (a) Plated type, (b) Solid cuprous thiocyanate in contact with copper plated wire, (c) Copper metal powder in contact with solid cuprous thiocyanate,.

Transport number measurements of potassium thiocyanate and sodium thiocyanate solution by air-lock moving boundary method are confirmed by the results obtained by the E. M. F. method. The final results obtained by the two independent methods have been examined from the stand-point of the inter-ionic attraction theory. The experimntal curve merges with the limiting slope derived from Onsager's theory :

$$\left(\frac{dT_+}{d\sqrt{c}}\right)_{c\to 0} = \frac{(Z_+ + Z_-)T^\circ_+ - Z_+}{\Lambda_\circ} \, \beta \sqrt{(Z_+ + Z_-)}$$

The potassium ion and sodium ion transport number curves appear to be normal and approach the limiting slope in the usual manner for the uni-univalent electrolyte (Longsworth, *J. Amer. Chem. Soc.*, 1935, *57*, 1185). There is no evidence of any complex formation up to a concentration of $2N_{\cdot\cdot}$

### 98. Studies of Joshi Effect in Iodine Vapour Under Electrodeless Discharge.

A. P. SAXENA, Indore and C. N. RAMACHANDRA RAO, Banaras.

Detailed investigations on the phenomenon $\Delta i$ were made in $I_2$ vapour enclosed in discharge tubes of different lengths ($l$) excited by alternating potentials ($V$) applied externally by making contact with metallic electrodes of diameter ($d$). The current ($i$) was investigated by a C. R. O. and a galvanometer actuated by a diode. Threshold potential ($V_m$) which marked the change of the nonself maintained to self maintained discharge increased with $l$ and unaffected by $d$. Increased of both $l$ and $d$ enhanced $i$. Below $V_m$, a very large positive effect characterised by initiation of h.f. pulses on the current trace was noticed. This inception of $+\Delta i$ was apparently not instantaneous and required a time period of $\omega$ 3 sec after the act of irradiation With increase of V, $+\Delta i$ decreased and changed sign to give $-\Delta i$. Thus e.g. for $l = 77$ mm., % $+\Delta i$ was 83 at 0.8 kV. and —100 at 0.93 kV. Increase of $l$ and an opposite change of $d$ favoured $-\Delta i$ and inhibited $+\Delta i$.

At a fixed $l$ and $d$, while $V_m$ and $i$ decreased, $-\Delta i$ increased numerically, with ageing, $+\Delta i$, however, was disfavoured.

Irridiation in part of different electrodes (H.T. and L.T.) and discharge space showed that $-\Delta i$ was maximum only when H. T. was illuminated indicating thereby that the electrode surface primarily that of the Cathode was the chief determinant of $\Delta i$.

### 99. Physico-Chemical Behaviour of some Typical Soils.

K. P. SHUKLA, Roorkee.

In a previous communication (Proc. Indian Science Congress 1951 pp. 245) it was reported that the engineering properties of soils such as Atterberg's Limits, Shear, Consolidation, Moisture adsorption, Compaction and other characteristics are profoundly influenced by crystal structure of clay minerals predominating in them. In continuation with these investigations dehydration, titration acidity and swelling characteristics of soil acidoid separated from typical soils collected from different parts of the country were studied. The results obtained also furnished additional information regarding the type of clay minerals in any particular soil.

Mineral colloids free from organic matter, uncombined salts and exchangeable bases were prepared. They were chemically analyzed for $SiO_2$, $Al_2O_3$, $Fe_2O_3$ and base adsorption capacity.

For dehydration studies weighed quantities of colloids were heated in muffled furnace to constant weight at predetermined temperatures between 110 and 800°C and curves between loss of moisture and temperature were plotted, These curves are characteristic for the type of soil and show the relative strength of forces with which the three types of soil moisture namely hydroscopic, and adsorbed moisture is lost and follows a parabolic path. The relative amounts of this type of moisture are proportional to surface reactivity of colloids. After the inflexion the loss of moisture is chiefly from crystal lattice the relative amounts of this type of soil moisture and the ease with which it is lost depend upon the structure and mineralogical composition of the type of soil.

Similarly the nature of soil acid as shown by electrometric titration curves obtained after titrating H-soil colloids with N/10 $Na_2CO_3$, bring out distinctive behaviour of each of the soil type.

The swelling experiments, finally, afford additional information type of clay minerals. The adsorption of water being both the function of specific active surface as well as of the character of space lattice.

These studies confirmed that Kaolinitic soils because of these compact structure and low surface reactivity have more favourable structural properties. The Beidellite type of certain soils of South West U. P., Poona and part of Mysore have a comparatively porous structure on account of which they have adverse physical properties.

### 100. Adsorption of Phosphate by Magnesium Oxide.

P. R. SINHA, Jadavpur.

The adsorption of common anions like chloride, sulphate etc. by magnesium oxide (mineral brucite was actually taken) is negligible. The adsorption of phosphate by magnesium oxide is much higher than that by aluminium oxide. In neutral solution the adsorption is so high, even with coarse particles, that it cannot be accounted for by exchange reactions on the surface. The solubility of magnesium phosphate is much greater than that of aluminium phosphate; as a result, magnesium oxide appreciably goes into solution in presence of phosphate at low pH. The solubility of magnesium phosphate increases in presence of ammonium salts; the increased solubility of phosphatised magnesium oxide in ammonium acetate solution is a strong evidence in favour of the chemical nature of such adsorption. The similar to that from alumina, in the fact that Mg, like Al, also goes into solution along with phosphate. The chemical nature of phosphate adsorption is more clearly demonstrated in the case of magnesium oxide than in alumina.

### 101. Adsorption of Phosphate by Aluminium Oxide.

P. R. SINHA, Jadavpur.

The existence of anion exchange in aluminium oxide is beyond doubt but the adsorption of common anions such as chloride, sulphate, chromate etc. is so weak that washing with water or aqueous alcohol is enough to remove the adsorbed anions. Adsorption of phosphate by alumina compared to other anions appears to proceed in a somewhat different way; firstly, the quantity of adsorbed phosphate is much higher than the other anions mentioned; secondly, that adsorbed phosphate is not entirely replaceable by other anions except oxalate or citrate. The oxalate or the citrate extract brings nearly equivalent quantity of Al and P into solution, rather by a process of solution than anion exchange. A chemical reaction between Al and P is therefore envisaged. Fluoride which completely replaces adsorbed phosphate is also likely to react with alumina to form insoluble aluminium fluoride. The process appears therefore to be similar to adsorption of phosphate.

## 102. Studies on the bi-univalent electrolytes in aqueous solution—Copper acetate.

S. C. SIRCAR, S. ADITYA and B. PRASAD, Cuttack.

Cells of the type

$\mathrm{Hg} \mid \mathrm{Hg_2Ac_2},\ \mathrm{CuAc_2}(c)\ \mathrm{HAc}(c_1) \parallel \text{Sat Kcl} \parallel \mathrm{HAc}\ (c_2)\ \mathrm{BaAc_2}(c)\ \mathrm{Hg_2Ac_2} \parallel \mathrm{Hg}$

Bridge

were studied. The values of $c_1$ and $c_2$ were selected in such a way that the $p_H$ value of the solutions of the cells of the two half elements were the same. The presence of acetic acid was necessary to suppress the hydrolysis of copper acetate and barium acetate. Assuming that the liquid junction potential to be negligible and barium acetate to be completely dissociated within the range of concentration studies (0.01 --- 0 1 M), concentration of free acetate ion in copper acetate was calculated from the knowledge of the e.m.f. of the cell and some assumptions about the activity coefficient. The dissociation of copper acetate was found to take place in two stages $\mathrm{CuAc_2} \rightleftharpoons \mathrm{CuAc^+} + \mathrm{Ac^-}$. The dissociation constants were found

$$\begin{array}{l} \mathrm{CuAc_2} \rightleftharpoons \mathrm{CuAc^+} + \mathrm{Ac^-} \\ \qquad\ \ \updownarrow \\ \qquad \mathrm{Cu^{++}} + \mathrm{Ac^-} \end{array}$$

on the basis of certain assumptions regarding the variation of activity coefficient with ionic strength by the method of approximation. The approximations were necessary to give exact resultst which are $K_1$ $(\mathrm{Cu\ Ac_2} \rightleftharpoons \mathrm{CuAc^+} + \mathrm{Ac^-}) = 0.125$ and $K_{-}$ $(\mathrm{CuAc^+} \rightleftharpoons \mathrm{Cu^{++}} + \mathrm{Ac^-}) = 4 \times 10^{-3}$.

## 103. Influence of 'ageing' under discharge and 'rest period' on *Joshi Effect* in nitrogen in blank and KCl coated ozonizers.

C. SRIRAMURTI and M. V. RAMANAMURTI, Banaras.

The profound influence of 'ageing' and 'rest period' on *Joshi Effect*, $\Delta i$ in nitrogen in *freshly* prepared ozonizers, has been already reported (*Chem. Sec.*, Part III, *A*. *23*, 56, 1952). These studies are now extended to ozonizers which were in *long use*. Purified sample of nitrogen, filled in Siemens' ozonizers at the optimum pressure *viz.*, 20 mm Hg productive of maximum $\Delta i$, was excited by 50 $\omega$ potentials (0.4 — 2.0 kV). Some of the ozonizers had annular walls filmed with KCl.

Unlike in *fresh* ozonizers, threshold potential, $V_m$ remained unaltered as a result of 'ageing' or 'rest period.' Due to 'ageing,' $i_D$ at any fixed V increased in blank ozonizers while it is reduced in coated ozonizers; a 'rest period' affected otherwise. Large $-\Delta i$ as 82 to 85 % current diminution was observed $V > V_m$; it decreased with V and at very large V (especially in filmed ozonizers) $\Delta i$ changed over to $+\Delta i$. The potential characterised by $\Delta i = 0$, decreased as a result of 'ageing.' 'Rest period' disfavoured both $+\Delta i$. The inversion $\rightleftharpoons \Delta i$ $+\Delta i$ was found to be potential reversible. The above significant changes in $i$ and $\Delta i$ due to 'ageing' and 'rest period' *long used* ozonizers are, however, considerably less marked than in *fresh* ozonizers.

**These findings are explained in the light of Joshi's theory of the phenomenon, Δ *i* which contemplates the formation under discharge of a boundary layer on the electrode walls as a primary step.**

### 104. Conductivity of Iodine Solutions : Water—Ethanol System.

N. R. SUBBARATNAM and A. K. BHATTACHARYA, Saugor.

The conductivity of N/2000 solution of pure Meck's Iodine dissolved in water increases with time and becomes a constant after 25 minutes. But addition of alcohol to these water solutions of iodine, up to 50 % alcohol, seems to accelerate this hydrolysis in presence of Platinum electrodes as catalyst The rate of increase in conductivity is greater in greater proportions of alcohol.

The plotting of conductivity against time shows that in all these cases after about 20 minutes we get all straight lines indicating a zero order reaction. Inspite of the decrease in dielectric constants, the rate is increasing showing the effect of the greater reactivity of the combined state of iodine in alcohol.

But there are three different zones of reactivity, Viz. 0-10 %, 20-30 % and 40-50 %. In the first zone the general tendency is not so much to increase even upto 60 minutes. In the other two zones there is phenomenal increase in the rate. In their own zones, the rate is proportional to the alcohol content.

The existence of such zones and the increase in rate is explained by hydrogen bond formation between the water and alcohol molecules being predominant in the low zones and the complex formation of Iodine with alcohol in the other two zones.

Ultraviolet light absorption measurements exactly correspond to the conductivity results.

### 105. Region favourable for the Occurrence of Joshi Effect Under H. F. excitation

N. SUBRAHMANYAM and N. A. RAMAIAH, Banaras.

Review of literature having shown absence of information on the above phenomenon Δ i, under H.F. potentials V, detailed investigations were made in iodine vapour employing fields of radio frequencies. Hartley type oscillators specially constructed for the purposes, gave V of undamped oscillations, 0.1 — 10 Mc ; damped oscillations were obtained by the method employed by Thomson and Coworkers. In agreement with earlier results due to MacKinnon and others, the potential range over which studies could be made was divided into three regions : (i) Intermittent and faint glow region in which *i* increased appreciably with V, (ii) bright glow region where *i* was inhibited initially and (iii) that in which the luminosity existed in the form of rings and *i* increased once more with V. As emphasized by Townsend, (*i*) was maintained by the *electrostatic* field while (iii) was governed chiefly by the self magnetic field produced by ion currents ; (ii) was controlled by both. It was interesting to note that − Δ i corresponding to 60 — 70 % current diminution followed by suppression of large number of pulses forming the current trace, was detected in the electrostatic region (i) ; − Δ i decreased progressively with V in (ii) and was undetectable at large V in (iii) under damped oscillatory discharge which was chiefly *electromagnetic* in character, Δ i was negligible. only + Δ i was observed. The significance of these results was discussed.

### 106. Kinetics of Decomposition of Diazonium Compounds.

C. R. TALPADE and K. Z. PATIL.

The kinetics of the decomposition of diazonium compounds has been studied mainly from the point of view of determining the factors influencing the stability of diazonium compounds.

The effect of (i) Concentration, (ii) Temperature (iii) $p_H$ value of the diazonium solution and (iv) the acid radical attached to the diazonium group, on the rate of decomposition of benzene diazonium; $\alpha$ —and $\beta$ —naphthalene diazonium compounds has been studied. It is observed that the temperature determines to a greater extent the rate of decomposition of the diazonium compounds. Other factors enumerated above, are effective in controling the coupling tendency of the diazonium compounds.

The diazonium solution whether prepared by dissolving solid diazonium compound in water or by dissolving and diazotising amine hydrochloride, gives identical results; showing that the presence of impurities like NaCl etc. does not influence the course of the reaction.

The stability of the diazonium compounds seems to depend on the number and position of the benzene rings attached to the diazonium group; greater number of rings introducing greater stability.

### 107. Multimolecular Adsorption from Binary Liquid Solutions.

C. R. TALPADE and V. K. WAGADARIKAR, Poona

Adsorption of gases and adsorption of a solute from a solution are similar in nature as indicated by the widespread application of the Langmuir and Freundlich isotherm equations to both types of behaviour. The Bruneur, Emmett and Teller equation which assumes multimolecular adsorption should be applicable therefore to adsorption from solutions also. The B. E. T. equation has been applied in case of adsorption from solutions the two components of which, are completely miscible with each other and wherein both the solute and the solvent are adsorbed. A case in point will be adsorption of Acetic Acid and Water on coal from a solution of acetic acid in water. In such a case the value of reduced concentration $c/c_0$ merely represents the percentage of one of the components. It is shown that the B. E. T. equation is completely applicable even in those cases where both the components—the solute and the solvent—are adsorbed. The surface areas as calculated from the separate values of number of molecules in one complete layer agreed with each other.

### 108. Studies in the nature of hydrated chromic oxide. Part IV. Solubility of different samples of hydrous chromium oxide in sulphuric acid solutions.

SWARUP NARAIN TEWARI and SATYESHWAR GHOSH, Allahabad.

It has been reported in a number of publications from these laboratories that the hydrous oxides especially those of amphoteric nature quickly age and lose their chemical reactivity. It is well-known that such hydrous oxides as those of aluminium, chromium, tin etc., on ageing become completely insoluble in acids. The present paper deals with the study of dissolution of chromium hydroxide in a mineral acid as sulphuric acid. It has been previously observed that the nature of hydrous chromium oxide is considerably effected on the conditions of its precipitation. Such different samples have been used for the purpose mentioned above. The ageing of different samples is allowed to take place under water kept at different $p_H$ values by adding suitable buffer solutions.

The results obtained show that the solubility of the hydrous oxide quickly diminishes with age specially when it tis allowed to remain at $p_H$ 8. i.e. slightly alkaline. Further it is noted that ageing is conspicuous with the samples prepared at room temperature than those obtained at higher temperatures. The rate of ageing as determined by the solubility of the hydrous oxide in sulphuric acid is quicker for the sample B obtained by the interaction of quivalent amounts of a soluble chromium salt and caustic soda than the samples obtained either by deficit (C) or excess (A) of alkali. It is also observed that the solubilities of different samples are in the following order when they are freshly prepared :—

Sample B $>$ Sample C $>$ Sample A

This result seems anamolous as ageing is remarkable only in alkaline medium and therefore the solubility of sample B should have been smaller than sample C. This behaviour is explained from the amorphous nature of sample B as revealed by x ray spectrograph studies.

The results obtained here support our contention that the ageing of such hydrous oxides is due to their amphoteric nature as is shown by the following equations : -

$$Cr(OH)_{++} \rightleftharpoons Cr(OH)_{2+} + OH^{1} \text{ ----------------- } (I)$$

$$2Cr(OH)_{2} \rightleftharpoons Cr_2O_3 + 2H^{+} + H_2O \qquad (II)$$

$$H_{+} + OH^{1} \rightleftharpoons H_2O \text{ ----------------------------- } (III)$$

## 109. The Kinetics of the decomposition of Benzoyl Peroxide in Amines.

H. R. ZAIDI.

It has been observed that the decomposition of benzoyl peroxide is accelerated by the presence of amines. A study of the kinetics of the decomposition of benzoyl peroxide in the presence of aniline, methyl-aniline and dimethylaniline in benzene solution has been made. The rates have been observed to follow a second-order law. The rates increase in the order :

aniline $<$ dimethylaniline $<$ methylaniline

An electron-transfer mechanism has been postulated by other workers and has been confirmed by results obtained in this study. Dimethyl-aniline functions as an effective redox activator for the polymerization of styrene in the presence of benzoyl peroxide at low temperature.

### 110. Separations of fatty acids using urea adducts.

K T ACHAYA and S. A. SALETORE, Hyderabad.

Urea-adduct separations have been applied to fatty acids. Separation of ricinoleic (containing linoleic) from oleic (containing a little linoleic) acid has been used as a step in the component fatty acid analyses of mixtures containing hydroxy acids. The mixed fatty acids of groundnut oil have been resolved into four fractions—saturated, low-grade oleic, high-grade oleic and unsaturated. From safflower seed oil fatty acids linoleic acid has been obtained in good yield in over 90 per cent. purity, while linseed oil mixed fatty acids have yielded concentrates of iodine value 240.

### 111. Oxidation of Nitroso Compounds.

SAIYAD SHAMIM AHMAD and E. C. DANIEL, Aligarh.

Oxidation of nitroso compounds supplies an easy route to nitro compounds as the nitroso derivatives can be obtained in pure form and high yields. Morever this process is much more controllable than direct nitration. It has been found that the yields from oxidation with dilute $HNO_3$ can be quite appreciably increased by the addition of certain catalysts. The catalysts and the yields are given below :-

(1) No catalysts (66 3 %); (2) $Fe^{\cdot}$ (66 %); (4) Ag (68 %); (4) $Cr^{\cdots}$ (69 %; (5) Hg (70 %): (6) $Ni^{\cdot}$ (72 %); (7) $Mn^{\cdot\cdot}$ (75 %); (8) $Co^{\cdot}$ (76 %); (9) $Pb^{\cdot}$ (85 %).

Other phenols eg. cresol behaved similarly. The reactive compounds get nitrated at the same time. This method, however, failed in the case of nitrosoaniline.

### 112. Synthesis of (1) 7-benzyl-6-hydroxy-methyl-coumarone and
### (2) 7-benzyl-6-hydroxy-5 (?)-bromo-3-methyl-coumarone.

J. M. ATHAVALE and M. S. MARATHOY, Poona.

8-Benzyl-7-hydroxy-4-methyl-coumarin, I, m.p. 238°, (Mullaji and Shah, Proc. Ind. Acad, Sci., 34, 173, 1951) on bromination with one molecule of bromine gave 8-benzyl-7-hydroxy-4-methyl-3-bromo coumarine, m. p. 245°, $C_{17}H_{13}O_3Br$. II ; (acetate, m.p. 197° ; benzoate, m.p. 154°). On hydrolysis with NaOH, II gave 7-benzyl-6-hydroxy-3-methyl-coumarilic acid, m.p. 203°, $C_{17}H_{14}O_4Br$, III, equi. = 282, which lost $CO_2$ when heated at 210° and gave 7-zenzyl-6-hydroxyl-3-methyl-coumarone, m.p. 81°, $C_{16}H_{14}O_2$, IV, which can also be obtained from II by refluxing with 10 % $Na_2CO_3$.

On treatment with two mols of bromine I gave 8-benzyl-7-hydroxy-4-methyl 3 : 6 (?)-dibromo coumarin, M.P. 190°, $C_{17}H_{12}O_3Br_{2}$. V; (acetate, m.p. 205° ; benzoate, m.p. 202°, methyl ether. m.p. 176°). 7-Benzyl-6-hydroxy-5 (?)-bromo 3-methyl-coumarone, m.p. 105°, $C_{16}H_{13}O_2Br$, VII, was obtained from V by the action of 10 % $Na_2CO_3$ as well as by decarboxilation of the corresponding coumarilic acid, m.p. 212°, $C_{17}H_{13}O_2Br$, VII, was obtained from V by the action of 10 % $Na_2CO_3$ as well as by decarboxilation of the corresponding coumarilic acid, m.p. 212°, $C_{17}H_{13}O_4$. Br, VI, obtained from V by the action of alkali.

### 113. Chemical Investigation of the Roots of Desmodium Gangeticum.

B. K. AVASTHI and J. D. TEWARI, Allahabad.

Chemical investigation of the roots of Desmodium gangeticum has revealed that presence of the following chemical constituents : (1) resin, (2) alkaloid, (3) wax, (4) organic acid, (5) a neutral substance, (6) colouring matter, (7) sterol, (8) sugar and (10) essential oil.

### 114. Color and Constitution of Normal and unsymmetrical phthalin group of dyestuff.

S. S BAIJAL and T D. TEWARI, Allahabad.

### 115. Synthesis of Methyl 7—Keto—1, 2, 3, 4, 4a, 5, 6, 7—Octahydronaphthoate and its 8—Methyl Derivative.

D. K. BANERJEE and J. DATTA, Calcutta.

It has been possible to incorporate in a bicyclic system the unique features of Hagemann's ester by the following method. Ethyl m—methoxyphenylcyanoacetate b.p. 156—7 (1.5 mm.), prepared from m—methoxybenzyl cyanide was reacted with methyl acrylate in the presence of a trace of sodium ethoxide and the resulting product was hydrolysed with dilute hydrochloric acid to yield α—(m-methoxypheny)-glutaric acid m.p. 120.5—1°. The latter on cyclisation gave 7—methoxy-4-keto—1, 2, 3, 4—tetrahydronaphthoic acid, m.p. 151—3° which on reduction by Huang—Minlon's modified procedure of Wolff-Kvishner's method yielded 7-methoxy—1, 2, 3, 4, tetrahydronaphthoic acid, m.p. 136°-8°. This acid was previously obtained by Fieser and Holmes by an altogether different method. Methyl 7-keto—1, 2, 3, 4, 4a, 5, 6, 7—octahydronaphthoate was obtained from the above tetrahydronaphthoic acid by the Wilds and Nelson's modified procedure of Birch reduction, hydrolysis, esterification and migration of the $\Delta^{4a:8a}$ double bond to the $\Delta^{8:8a}$ position. Methylation of the keto ester with sodium hydride and methyl iodine gave the desired methyl 7-keto-8-methyl—1, 2, 3, 4, 4a, 5, 6, 7—octahydronaphthoate, the structure of which was proved by its alkaline hydrolysis to 1-methyloctalone—2, the melting point of the semicarbazone of which remained undepressed on admixture with the semicarbazone of an authentic specimen of 1-methyloctalone-2.

### 116. A New Synthesis of Some Derivatives of $4,4^1$-Stilbenediol.

P. M. BHARGAVA and S. HUSAIN ZAHEER, Hyderabad-Deccan.

The product of the condensation of Chloroacetone (1 mol.) with phenol (2 mols.) in presence of concentrated sulphuric acid (1 mol.) at—10° to 0°C., has been identified as α-methyl-4, $4^1$-stilbenediol (a lower homologue of the well-known synthetic oestrogenic hormone stilbesterol), m.p. 183-184°C., which has been characterised by preparation of some of its esters and ethers. A probable mechanism for the reaction leading to the formation of α-methyl-4-$4^1$-stilbenediol is put forward. On the basis of this mechanism, the reaction would appear to be generally applicable to ketones of the formula R-Co-CHClR$^1$, where appear to be generally applicable to ketones of the formula R-Co-CHClR$^1$, where R is a lower alkyl radical and R$^1$ is hydrogen or a lower alkyl radical, and any simple aromatic coupound containing a suitably activited available nuclear hydrogen atom. Formation of α -methyl-4,4$^1$-dimethoxy and α -methyl-4,4$^1$ diethoxystilbenes in very good yields by condensation of anisole and phenetole respectively, with chloroacetone, under similar conditions as above, is cited as an evidence for the apparently general applicability of the reaction. The above synthesis is a direct one involving only one step, whereas the numerous other synthesis of α -alkyl- or - , $^1$-dialkyl-4,4$^1$-stilbenediols, and of their derivatives, several of which exhibit remarkable oestrogenic activity, have so far mostly been by demethylation of the corresponding dimethyl ethers, and have invariably involved several stages.

## 117.—Essential Oil From Leaves of Guava, Psidium Guayava, Linn.

*Part II. (Bangalore variety)*

ASHARAM BHATI, S. C. BHATTACHARYYA and P. C. GUHA, Bangalore.

The leaves of guava gave on steam distillation a greenish oil in 0.26 per cent yield with an agreeable smell and the following analytical constants: $D_4^{26}$, 0.9001; $n^{25°}$, 1.4882; $\alpha_D$, + 5.5°; Acid No.1, 1 and Ester No. 12,3,

, d and dl-limonene, β-caryophyllene, a new bicyclic sesquiterpene of the cadinene type and two new cadinylic alcohols have been isolated from this oil. A preliminary study of these new constituents has been done.

The oil has been found to inhibit the growth of Coli-typhoid organisms, and also that of tho ordinary pyogenic organisms, Staphylo cocci and streptococci.

## 118. Studies on the Infra-red Spectra and Degradations of Kopsine, the alkaloid of Kopsia fruticosa.

ANIL BHATTACHARYA, Calcutta.

Kopsine, the alkaloid of *Kopsia fruticosa* (J Amer. Chem. Soc., 1949, *71*, 3370), $C_{22}H_{26}O_4N_2$, m.p. 217°, dec. is an N-acetyl indole derivative, It could be established from the studies of the infra-red spectra of Kopsine its mild hydrolysis product kopsidine, $C_{20}H_{24}O_3N_2$, m.p. 142. Infra-red spectra of kopsine also suggests that the alkaloid contains a carbomethyxy (-cooM –) and amide (-NCo) groups, the characteristic absorption bands being at 5.71 and 5.96μ respectively, The presence of these groups could not, however, be established by ordinary chemical methods. such as, hydrolysis, but were finally confirmed by $LiAlH_4$ reduction of kopsine when a methoxyl free base—kopsidea $C_{21}H_{26}O_2N$, m.p. 248° was obtained. Infra-red spectra of kopside also showed the absence of absorption bands characteristic of carbomethoxy and amide groups. On selenium dehydrogenation, kopsine produces several compounds from which skatole, $C_9H_9N$, m.p. 93° has been isolated and identified. On distillation with zinc dust kopsine yields β -ethyl indole, $C_{11}H_{11}N$ which has been isolated and characterised as its picrate $C_{10}H_{11}N.C_6H_2(OH)(NO_2)_3$, m.p. 115-116°.

### 119. A Study on Aminocompounds in the Sugarcane Products, Part I.

H C. BHATTARCHARYA and S MUKHERJEE, Kanpur

Amino-compounds in sugarcane juice are known to react with carbohydrates to form various products under different conditions.

The identification of these amino-compounds in two varieties of cane juice was previously attempted by paper partition chromatography method using ion exchange resins for preparing the concentrate by Wiggins, et al; but the effect of variable factors like soil, variety, climate, manuring, etc being involved in the present study, a chromatographic examination of the juice and molasses has been made. The filtered juice and diluted molasses of about 13 Brix were passed through a properly teated column of Duolite C-3 or N. C. L. cation exchangers. The amino modies adsorbed on the resin was eluted with 2N HCl and washed with water. The eluate was concentrated, but neither the eluate nor the concentrate gave distinct spots. So, the concentrate was purified by refluxing the evaporated chlorides of amino-compounds in alcohol, filtering and the filtrate treated with lead carbonate and silver oxide, removing the halogen subsequently by $H_2S$ and finally decolorising by active carbon and evaporating. This product was applied for running two-dimensional chromatograms using n-butanol acid-water (40 : 10 : 50 vol. basis) followed by a run in phenol-water-mixture (phenol being specially purified for the purpose). The following compounds have thus been detected: aspartic acid, glycerine, aspargine, serine, glutamic acid, alanine, valine, leucine (nor leucine), lysine Further work is in progress.

### 120. Studies in the aromatic Nitro Compounds.

H. BISWAS, Calcutta.

When mono-chlorobenzene is nitrated, ortho-and para-nitro chlorobenzenes are formed in a fixed proportion. It has been found, however, that if in a charge ortho-nitrochlorobenzene is initially added to the quantity which would have been formed in that particular charge then the further formation of the ortho-isomer is hindred, while the formation of the para-isomer is greatly favoured. Further work in the series is in progress.

### 121. Interaction of Bromine with Methylamine.

Miss I. BOKIL and M. A. PRASADA RAO, Banaras.

When to a dry solution of Methylamine (2 mols) in benzene is added a solution of bromine (1 mol) in benzene a white crystalline precipitate is obtained which has been identified with Methylamine hydrobromide. From the solution a deep yellow-red oily liquid b.p. 104° (d) is obtained. It is sparingly soluble in water and is reactive towards potassium iodide in an acidic medium. From the quantities of the products formed and the reactants used, following reaction appears to be taking place :

$$2\ \mathrm{Me\ NH_2} + \mathrm{Br_2} = \mathrm{Me\ NH\ Br} + \mathrm{Me\ NH_2\ HBr}.$$

### 122. Stereochemistry of the Reaction of Cyclohexylamines with Nitrous acid.

AJAY KUMAR BOSE, Kharagpur.

On the basis of the concept of polar and equatorial bonds the following rules can be formulated for correlating the behaviour of cyclohexylamines with nitrous acid :

When the amino group forms an equatorial bond the main reaction product is the corresponding alcohol with the hydroxy group equatorial (that is no Walden inversion takes place) :

When the amino group is linked through a polar bond, considerable amounts of chclohexenes are formed along with a mixture of both the epimeric forms of the alcohol (that is Walden inversion occurs).

These rules have been tested for 1:2-, 1:3- and 1:4-methyl-cyclohexylamines, menthylamines, carvomenthylamines and trans-decalylamines and found to be valid. The conformation of these compounds was detetrtmined on the basis of the principle that the sodium and alcohol reduction of a ketone or an oxime leads to that epimer of the corresponding alcohol or amine which has the hydroxy or the amino gronp in the equatorial position.

### 123. N-Acylation Under Non-basic conditions.

AJAY KUMAR BOSE, Kharagpur.

In connection with our work on $\beta$-lactams it was necessary to acylate under non-basic conditions aminomalonic esters with various $\alpha$-halo acids. Employing a technique used in the dyestuff industry for preparing aryl amides we have acylated aminomalonic esters in excellent yield by refluxing their solution in an inert solvent with an $\alpha$-halo acid and phosphorus trichloride. We have found that the acid chloride may be substituted for the mixture of an acid and phosphorus trichloride. Further, it is not necessary to have the free amino compound, a solution or a suspension of its hydrochloride in a chlorinated solvent can also be used successfully. The reaction product had a high degree ot purity and no racemisation was observed when optically active components were used.

The yield of the acylated product obtained by using a mixture of an acid and phosphorus trichloride was better than the overall yield in the usual two stage process in which the acid is first reacted with phosphorus pentachloride or thionyl chloride to give the acid chloride which in its turn is employed in a Shotten-Baumen reaction.

The acylation procedures described above are simple and are particularly well suited to derivatization of either carboxylic or amino compounds.

### 124. Decarboxylation of Fatty Acids.

M. CHAKRABARTY, Calcutta.

In continuation of previous papers on the subject (J. Ind Chem. Soc. Ind. & News Ed. Vol. IX, No. 3 & 4 and Proc. Ind, Sc, Cong, 1949 Pt, III, pp 83) in which the decarboxylation of oleic acid in presence of various catalysts was investigated. Further studies have been made with oleic acid and other mixed fatty acids to study the effects of vapour phase cracking in the presence of catalysts at high temperatures and at atmospheric and lower pressures. The course of decarboxylation was followed by the determination of acid value and actual measurement of $CO_2$ produced by absorption in Sodalime or ascarite. The amount of $CO_2$ absorbed was found proportional to the percent conversion. The comparative efficiency of the catalysts were determined under the same conditions.

### 125. A Spectroscopic analysis of "Swetenia Macrophylla" Seed Fat.

M. CHAKRABARTY and N. K. SEN, Calcutta.

The component fatty acids of the seed fat from "Swetenia Macrophylla" was investigated by modern spectroscopic methods and found to contain : 25.6 6 % linolenic, 11.9 % linoleic. 32.4 % eleic and 30.1 % saturated acids.

A simple type of isomerisation bath was devised for the purpose. The results indicate the possibility of the use of the oil in soap industry as such and in paint and edible fat industry after solvent segregation.

### 126. Fraxinifolin, the Active Principle of Evodia Fraxinifolia, Hook.

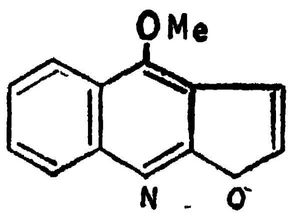
ASIMA CHATTERJEE (NEE MOOKERJEE), Calcutta.

From the matured bark of *Evodia fraxinifolia,* a neutral bitter crystalline substance, $C_{18}H_{22}NO_6$, m.p. 278, dec. (Yield 0.5 % of the weight of the dry bark) has been isolated. It appears to be a new compound and has been called fraxinifolin. It is readily soluble in acetone, chloroform, sparingly soluble in methyl alcohol, ethyl acetate, benzene, and glacial acetic acid and insoluble in ether, petroleum ether and water. Fraxinifolin dissolves in concentrated sulphuric acid producing a stable red colour but does not give any colouration with $FeCl_3$ in alcohol. It is optically active, $[\alpha]_D^{30} = + 87.4°$. It is free from $> C{=}O$, -OMe, $CH_2 < {}^{O}_{O}$ and ester groups. Fraxinifolin is not an epoxide. It does not contain any -COOH group but dissolves in alkalies and alkali carbonates producing a deep yellow solution which on acidification produces original substance. Fraxinifolin on acetylation produces a triacetyl compound $C_{25}H_{28}O_9$, m.p. 308-10°, dec. indicating that it contains 3 (OH) groups. Fraxinifolin when heated with HgO (yellow) in presence of alcoholic alkali produces metallic mercury showing that it is oxidisable.

### 127. An Approach to the synthesis of Dictamnine, the alkaloid of Dictamnus albus, Linn .... Synthesis of 4-hydroxy quinoline-2 : 3 α -pyrone.

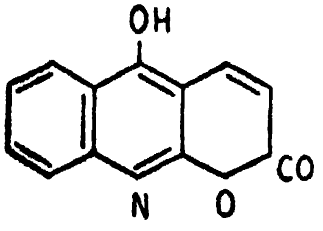
ASIMA CHATTERJEE (NEE MOOKERJEE) and ANIMA CHAUDHURY, Calcutta.

Dictamnine (I) $C_{12}H_9NO_2$, m.p. 132°, the alkaloid of Dictamnus albus Linn. *(Family Rutaceae)* is a furoquinoline derivative of linear configuration (Asahina *et al*, Ber., 1930, *63*, 2045).

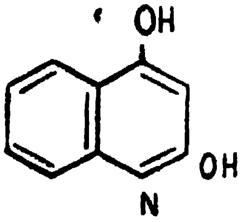


(I)

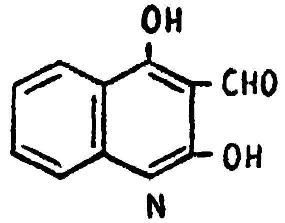
The corresponding demethyl pyrone compound of Dictamnine, *i.e.*, 4-hydroxy quinoline-2:3- α-pyrone (II) of linear configuration has been synthesised from 2:4-dihydroxy quinoline, $C_9H_7NO_2$, m.p. 335°, dec. (III), 2:4-dihydroxy quinoline has been prepared by a new method from ethyl anthranilate and ethyl acetate. They have been condensed in dry benzene or in xylene in presence of molecular sodium and the product obtained on subsequent acidification precipitated 2:4-dihydroxy quinoline (yield, 40-45 % of the theoretical). When subjected to Reimer Tiemann reaction, 2:4-dihydroxy quinoline produced the corresponding 3-aldehyde, $C_{10}H_7NO_3$, (which decomposes above 330°, without melting) in quantitative yield. This aldehyde was condensed with malonic acid at room temperature by the method of Doebner when 4-hydroxy quinoline 2:3 α -pyrone (II), $C_{12}H_7NO_3$ (decomposes above 160° without melting) was obtained quantitatively.



(II)



(III)



(IV)

## 128. Boron-trifluoride as a condensing agent for the Pechmann reaction.

Miss L. H. DALAL, G. D. SHAH and R. C. SHAH, Poona,

Boron-trifluoride has been lately introduced as a condensing agent for several organic reactions. The authors have investigated the use of boron-trifluoride ether complex, a convenient method for the preparation of which has been worked out at the National Chemical Laboratory, for the Pechann condensation. Resorcinol and methyl-B resorcylate have been condensed with aceto acetic ester ; 7-hydroxy coumarin derivatives were the main products. 5-1 hydroxy coumarin derivative expected to be formed by analogy with aluminium chloride, was not isolated in the case of methyl B-resorcylate.

## 129. Chemical investigation of Swertia Decussdta.

Miss S. R. DALAL, SURESH SETHA and R. C. SHAH, Bombay and Poona.

In continuation of the work reported last year, the stems from the plant have been chemically examined, and a second yellow colouring matter, a xanthone derivative has been isolated. The two xanthone derivatives have been named decussatin and swertinin, and have been tentatively assigned the structures of 3:4:7-trimethoxy-8-hydroxy xanthone and 3:4-dimethoxy-7:8-dihydroxy xanthone respectively. The isolation of these two new xanthones is of interest as only few naturally occuring xanthones are known.

### 130. Interaction of Thionyl Chloride and some Aromatic Hydroxy Ketones in Presence of Finely Divided Copper.

V. J. DALVI and G. V. JADHAV, Bombay.

The action of thionyl chloride on respropiophenone, resbutyro-phenone, res-benzophenone, and their monomethyl ethers in presence finely divided copper has yielded the corresponding thioethers, the constitutions of which have been proved by nitration. o-Hydroxy-propiophenone, 2-acetyl resorcinol and its monomethyl ether have yielded sulphur derivatives the constitutions of which are being investigated. 5-Nitro-resacetophenone and 5-nitro-respropiophenone have failed to react even under drastic conditions.

The action of sulphur monochloride and sulphur dichloride also on these ketones is being investigated.

### 131. Preparation of Sodium Antimony Gluconate.

S. J. DAS GUPTA, Calcutta

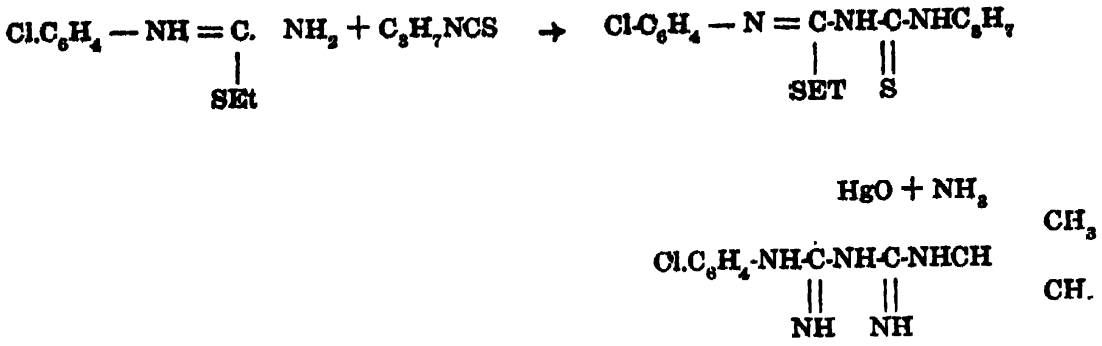
Sodium antimony gluconate is now extensively used in medicine as a remedy for Kala-azar and Filariasis. It has some advantages over Brahmachari's Urea Stibamine, in that its aqueous solution is very stable and can be kept for prolonged period without deterioration and can be administered by both intramuscular and intravenous route and its toxicity is much lower than Urea Stibamine.

A detailed method for the preparation of this valuable drug has been described in this paper. A solution of gluconic acid was prepared from calcium gluconate and oxalic acid and was concentrated to proper strength. This gluconic acid was then reacted with equimolecular quantity of anhydrous antimony trichloride and the antimony gluconic acid complex was converted to its sodium salt with caustic soda. The Sodium salt was then oxidised with hydrogen peroxide to convert the trivalent antimony to pentavalent state and finally the reaction mixture was made neutral with caustic soda and filtered when a clear solution of sodium antimony gluconate was obtained. The compound was precipitated in pure state from this solution by diluting with methyl alcohol, filtered, washed with methyl alcohol, dried and powdered. Aqueous solution prepared from this powder up to a concentration of 100 mg of antimony per c c. has been found to be of the same toxicity as the best foreign product.

### 132. A New Synthesis of Biguanide Compounds.

S. K. Deb, S. S. GUHA and P. C. GUHA, Bangalore.

In continuation of our work on the new methods of synthesis of biguanide derivatives similar to paludrine (Guha, S. S., and Guha. P. C., J. Sci. Industr. Res., *IIB*, 1952, 313; Guha, S.S., and Guha, P. C., J. Sci. Industr., Res., *IIB*; 1952, 317), we have worked out another method of synthesis of paludrine starting from arylpseudothioureas and alkylisothiocyanates. The synthesis of Paludrine may be represented as follows :—



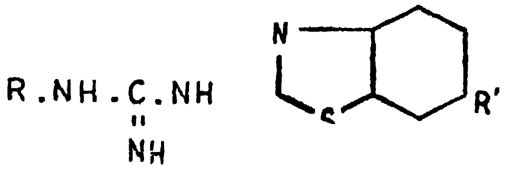
$$Cl.C_6H_4-NH=\underset{\substack{|\\ SEt}}{C}.\ NH_2+C_3H_7NCS \rightarrow Cl\text{-}C_6H_4-N=\underset{\substack{|\\ SET}}{C}\text{-}NH\text{-}\underset{\substack{\|\\ S}}{C}\text{-}NHC_3H_7$$

$$\xrightarrow{HgO+NH_3} Cl.C_6H_4\text{-}NH\text{-}\underset{\substack{\|\\ NH}}{C}\text{-}NH\text{-}\underset{\substack{\|\\ NH}}{C}\text{-}NHCH\begin{matrix}CH_3\\ CH_3\end{matrix}$$

## 133. Some $N^3$-sulphonamide Substituted Benzothiazolyl Guanidine Derivatives.

S. K. DEB, A. C. ROY, S. S. GUHA and P. C. GUHA, Bangalore.

In continuation of our work on sulphonamide substituted guanidine derivatives, many of which have shown very good antimalarial activity (under publication), it was proposed to introduce the 2-benzothiazole residue into the guanidine molecule. Benzothiazole derivatives (Fox and Bogert, J. Am. Chem. Soc., 1939, *61*, 2103; Jshii, Japan Med. J., 1948, *1*, 30) having various substituents at different positions are being tried, since long, for chemotherapeutic properties and 1-(2-benzothiazolyl)-2-thiourea was found to possess a quinine equivalent of one when tested for suppressive activity against duck malaria. Considering these facts, it was thought of interest to prepare compounds of the type A in which the sulphonamido and the benzothiazolyl residues would be connected by the therapeutically active guanidine residue. Accordingly sixteen compounds of the type A have been synthesised. The compounds have been prepared by reacting sulphonamido-cyanamides with the corresponding substituted amino-benzothiazole hydrochloride.



where (I) R = sulphameraziny1.
R¹ = (i) $CH_3$–, (m.p. 189-191°), (ii) $CH_3O$–, (m.p. 226-27°), (iii) Cl–, (m.p 238-239°), (iv) H–, 212°).
(II) R = sulphathiazole.
R¹ = (v) $CH_3$–, (m.p. 198-199°), (vi) $CH_3O$–, (m.p. 207-09°), (vii) Cl–, (m.p. 170-78°, (viii) H–, (m.p. 232°)
(III) R = sulphapyridine.
R¹ = (ix) $CH_3$–, (m.p. 181-82°), (x) $CH_3O$–, (m.p. 198°) (xi) Cl–, (m.p. 217-219°), (xii) H–, (m.p. 177-78°).
(IV) R = Sulphaguanido—
R¹ = (xiii) $CH_3$–, (m.p. 105°), (xiv) $CH_3O$–, (m.p. 236°) (xv) Cl–, (m.p. 230-231°), (xvi) H–, (m.p. 248°).

All the compounds have been isolated as their hydrochlorides.

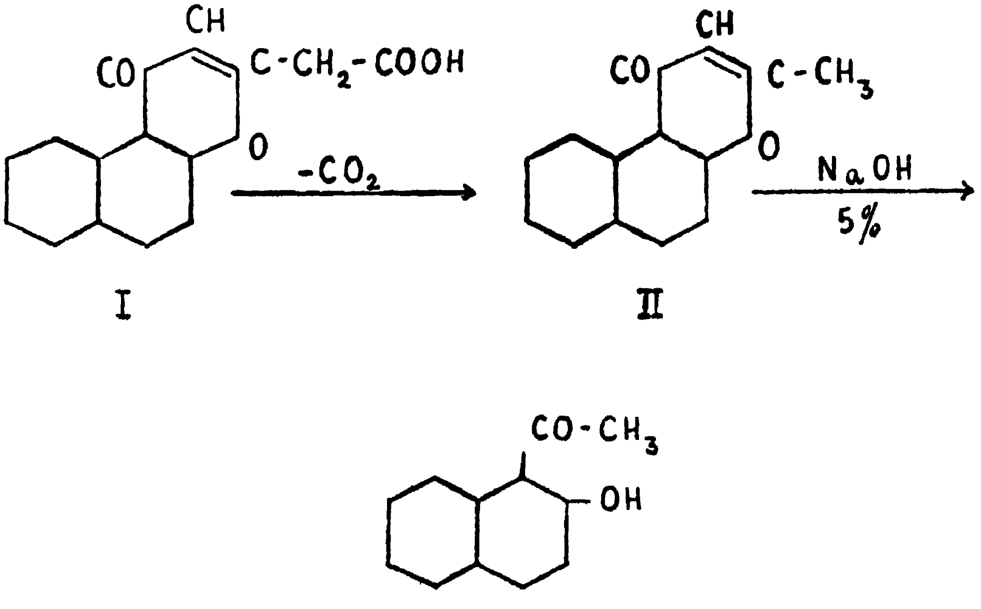
## 134. Condensation of β-naphthol with acetone dicarboxylic acid : Synthesis of 1 : 4 - βα-naphthapyrone -2-acetic acid.

R. M. DIXIT and V. M. DIXIT, Dharwar.

β -naphthol was condensed with acetone dicarboxylic acid by Dey (J. C. S 1915, *107*, 1606) using conc. Sulphuric acid as condensing agent, the only product of the reaction being the expected Coumarin acetic acid (m p. 202°—206° decomp ) to which the constitution of 1 : 2- βα -naphtha pyrone -4-acetic acid has been assigned. β -naphthol is also known to condense with aceto-acetic ester and yield a chromone derivative on using phosphorus pentoxide as the condensing agent. (Dey and Laxminarayan, J. Ind. Chem. Soc. 1932, IX. 149.)'. The Constitution of 2-methyl -1 : 4 - βα-naphthapyrone has been assigned to this chromone (m.p. 168°) The possibility of this chromone being formed along with the respective coumarin even with sulphuric acid as the condensing agent has been indicated by Dey (Loc cit ), who has tried to prove it by obtaining directly from the condensation product, a known styrene derivative of the chromone.

It occured to us, therefore, that a chromone derivative may also be obtained by condensing β -naphthol with acetone dicarboxylic acid in the presence of either (i)' Conc. sulphuric acid or (ii) Phosphorous pentoxide as the condensing agent. This expectation was fulfilled on our condensing β -naphthol with acetone dicarboxylic acid under modified experimental conditions, using either of these condensing agents. In addition to the 1 : 2 -βα-naphthapyrone-4-acetic acid, a new yellowish coloured acidic compound melting at 144° with decomp, was obtained in fairly workable yields in each case.

When carefully decarboxylated at the m.pt. the new acid changes to the known 2-Methyl—1 : 4-βα-naphtha-pyrone (2 : Methyl α -naphtha chromone) (II). the identity of which has been further established by its hydrolysis to 1 : aceto : 2 -naphthol (III)



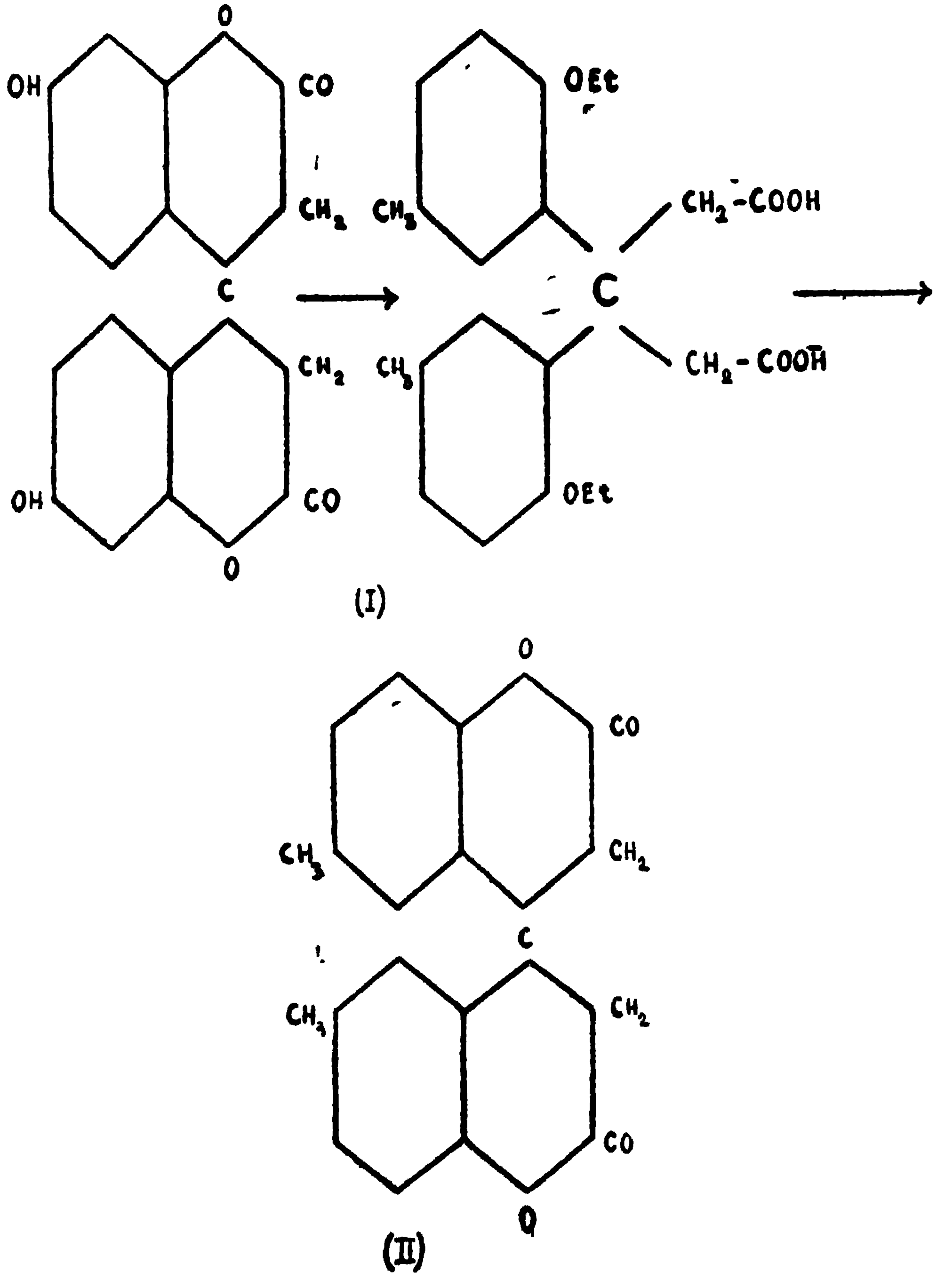
III

Both the original acid and the decarboxylated product show some of the characteristic reactions of chromones. The constitution of 1 : 4 ββ -naphthapyrone -2-acetic acid (I) is therefore proposed for the new acid.

## 135. Condensation of Phenols with Acetone Dicarboxylic Acid: Glutaro Dilactone from Meta Cresol.

V. M. DIXIT and B. R RAVIKIRAN, Dharwar.

A ββ-diaryl glutaro lactone (I) was obtained as a product of the condensation of Resorcin with acetone dicarboxylic acid in the presence of (i) anhydrous aluminium chloride, (ii) Phosphorus oxychloride, (iii) Phosphorus pentoxide and (iv) Thionyl chloride as condensing agents by Dixit, Kankudti and Mulay (J. Ind. Chem. Soc. 1945, 22, 207). Gogte (J. Proc. Ind. Acad, Sc, 1935, 2, 196) has reported the formation of a glutaro dilactone (II) by the lactonisation of ββ-di-(2-ethoxy-5-methyl phenyl) glutaric acid under the influence of 80 per cent sulphuric acid.

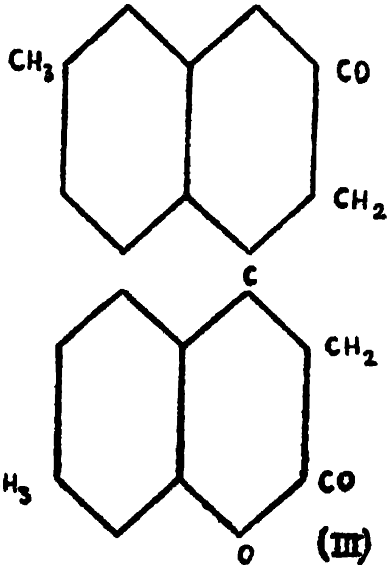


(I)

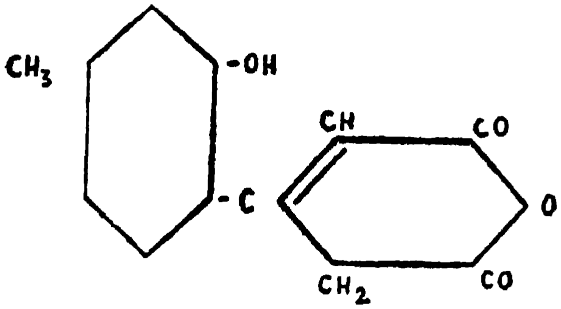
(II)

The formation, however, of such glutaro dilactones as products of a Pechmann condensation between phenols and acetone dicarboxylic acid in the presence of conc. sulphuric acid as the condensing agent has not been recorded. Dixit and Gokhale (J. Univ. Bom. 1934, *3*, 95) mention the isolation of a non-acidic compound from the products of a sulphuric acid condensation between (i) m-cresol or (ii) p-cresol on the one hand and acetone dicarboxylic acid on the other, but they have proposed for it the constitution of an anhydride of the corresponding β-aryl glutaconic acid which is generally known to be the intermediate unstable product of the condensation. The "glutaconic anhydride" thus obtained from m-cresol is reprted to melt at 212° (decomp). Another nonacidic product of the condensation of m-cresol and acetone dicarboxylic acid with $POCl_3$ as the condensing agent has been mentioned by Dixit and Kankudti (J Ind Chem. Soc. 1951, *28*, 323) but its constitution is not finally decided.

On repeating the condensation between m cresol and acetone dicarboxylic acid with conc. sulphuric acid as the condensing agent, a nonacidic product (m.p. 213°C.) has been isolated in fairly good yield from the condensation product. A careful study of its properties and reactions has revealed, however, that this compound is most probably the glutaro dilactone (III) and not the β -2-hydroxy-4-methyl phenyl glutaconic anhydride (IV) as suggested by previous workers.



(III)



(IV)

Further work is being carried out in support of the constitution of ββ -di-2-hydroxy-4-methyl phenyl glutaro lactone proposed for this nonacidic compound (213°C) and also for elucidating the constitution of the nonacidic compound (m.p. 160°C.) obtained by Dixit and Kankudti (loc. cit.) by condensing m-cresol with acetone dicarboxylic acid in the presence of phosphorus oxy-chloride.

### 136. Cyanine Dyes from β -Naphthaquinaldine.

M. Q. DOJA and SOMORENDRA NATH SANYAL, Patna.

Four new cyanine dyes have been prepared by the condensation of B-naphthaquinaldine ethiodide with p-diethylamino-benzaldehyde, p-toluquinaldine ethiodide, 6-ethoxy-quinaldine ethiodide and p-toluquinoline ethiodide, and their optical, photographic and other properties studied. The effect of the change of molecular weight, structure and substituents on the sensitising power of these and other related compounds has been discussed.

### 137. Search for New Antispasmodics. Part V.

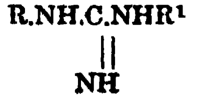
T. N. GHOSH, Calcutta.

A survey of the chemistry of antispasmodics shows that effective ones although varying widely in molecular structure, are salts of strong tertiary bases. This finding, coupled with the observation by previous workers that 3-methyl*iso*quinolines are effective spasmolytics of low toxicity, has now suggested that methyl- or ethyl-*iso*quinolines having one hydrogen of the methyl or ethyl group substituted by a tertiary amino group might be worthy of study. The approach towards the synthesis of such types of *iso*quinoline derivatives has now been made along the following routes: (1) subjecting the oxime of diethyl-aminophenylpentanone (Mannich and Schutz, *Arqh. Pharm.*, 1928, *265*, 684) to Beckmann rearrangement in presence of $POCl_3$ in toluene and subsequent ring-closure of the amide in the same operation. (2) Reduction of α-acetamido-β-diethylamino (or piperidino)-propiophenone (Ray Chaudhuri and Ghosh, *J. Indian Chem. Soc.*, 1951, *28*, 566) and subjecting the secondary alcohol, so obtained, to Bischler—Napieralski reaction. (3) Diethylaminoacetone is condensed with benzaldehyde to give 1-diethylamino-3-benzalacetone. The latter is hydrogenated in presence of palladium-charcoal and the oxime of the reduced product subjected to Beckmann rearrangement in presence of phosphorus oxychloride in toluene to furnish, by ring-closure of the amide in the same operation, an *iso*quinoline derivative containing a tertiary amino group.

### 138. Some $N^3$—sulphonamide Substituted Aryl Guanidines.

S. S. GUHA, A. C. ROY, S. N. SUR and P. C. GUHA, Bangalore.

Sulphonamides have been found to be very effective in its action on the asexual exo-erythrocytic forms and erythrocytic forms of the malaria parasites (Findlay *et al.*, Ann. Trop. Med. Parasit., 1946, *40*, 358; Marshall, J. Pharmacol., 1945, *84*, 1), Paludrine and sulphadiazine potertiate each other's action against sporozoite induced infections of *P. gallinaceum* in chicks (Grunberg *et al.*, J. Pharmacol, 1948, *94*, 60), but the two drugs in combination have got additive toxicity. With a view to find out a true causal prophylactic antimalarial drug, it was thought worth-while to prepare some guanidine derivatives which are also sulphonamides. The following fifteen compounds of the type A have been prepared



$$R.NH.\underset{\displaystyle \overset{||}{NH}}{C}.NHR^1$$

Type A.

where R = sulphonamides and $R^1$ = aryl.

These compounds were prepared by reacting the corresponding cyanamides with the appropriate hydrochloride of aryl amines or sulphonamides. All the compounds were isolated as their hydrochlorides. Guanadines of type A:

R = Sulphamerazine.
$R^1$ = (i) phenyl (m.p. 201°), (ii) p-chlorophenyl (m.p. 226°), (iii) p-bromophenyl (m.p. 239°), (iv) p-iodophenyl (m.p. 245°d) (v) p-tolyl (m.p. 236°), (vi) p-anisyl (m.p. 242°).
R = Sulphadiazine.

$R^1$ = (vii) Phenyl (m.p. 185°), (viii) p-chlorophenyl (m.p. 218°), (ix) p-bromophenyl (m.p. 230°), (x) p-iddophenyl (m.p. 241°d) (xi) p-tolyl (m.p. 215°), (xii) p-anisyl (m.p. 222°d.)
R = Sulphapyridine.
$R^1$ = (xiii) p-chlorophenyl (m.p. 181°), (xiv) p-anisyl (m.p. 203°)
R = Sulphaguanidine.
$R^1$ = (xv) p-chlorophenyl (m.p. 174-76°).

### 139. On the Preparation and Anti-Bacterial Action of Some P. A. S. and Mercurated P. A. S. Derivatives.

S. S. GUHA SIRCAR and SATCHIDANAND PATNAIK, Cuttack.

Twelve p-amino salicylic acid (P. A. S.)—aldehyde bisulphite compounds have been prepared. All the twelve derivatives have been mercurated along with P. A. S. No good anti-bacterial action was observed against E. Coli and Staphylo coccus aureus in the case of numercurated compounds but the mercurated compounds were quite active against E. Coli, Staphylococcus aureus and Mycobacterium phlei. The activities of a few of the compounds have been studied from the point of view of biochemical antagonism in presence of p-amino benzoic acid (PABA), nicotinic acid and cysteine, and definite antagonistic action was observed. The antibacterial tests have been carried out in Kirschner's synthetic medium.

### 140. Synthesis of 5 : 8-Dimethyl Cadalene.

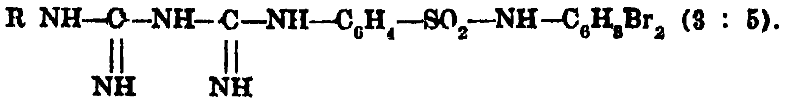
R. C. GUPTA and M. S. MUTHANA, Bangalore.

p-Cymene is condensed with methyl succinic anhydride in nitrobenzene solution in presence of anhydrous aluminium chloride to give β -(p-cymoyl-2-)α methyl propionic acid. Addition of methyl magnesium iodide to the ester of the keto acid yielded on hydrolysis and dehydration the unsaturated acid γ -(p-cynyl-2-) αγ -dimethyl, vinyl acetic acid, which on reduction with hydriodic acid and cyclization in presence of $AlCl_3$ gave 2 : 4 : 5-trimethyl 8-isopropyl-tetralone (b.p. 115-117/0.5 mm.; 2 : 4-dinitrophenyl-hydrazone m.p. 206.5°C.). Reaction of the substituted tetralone with methyl magnesium iodide followed by dehydrogenation resulted in the formation of 5 : 8-dimethyl cadalene distilling between 140-142°C./2 mm. [ Found : C, 90.27; H, 9.74. $C_{17}H_{22}$ requires, C, 90.265; H, 9.735 per cent ]. The hydrocarbon formed its picrate derivative with picric acid, which on repeated crystallization, registered a melting point of 137°C.

### 141. Studies in Sulpha-Biguanides. Some $N^1$—aryl-$N^5$-p-(sulphonamido—$3^1:5^1$—dibromo phenyl)—phenyl— biguanides.

P. R. GUPTA, M. RAGHAVAN and P. C. GUHA, Bangalore.

Studies in the field of sulpha-biguanides for the search of potential antimalarials, has now further been extended to include the active $3^1 : 5^1$— dibromo-phenyl-sulphanilamide. Accordingly, compounds of the following type, having both the biguanide and sulphanilamide moieties, have been synthesised and screened against experimental chick malaria.



$$R\,NH{-}\underset{\underset{NH}{\|}}{C}{-}NH{-}\underset{\underset{NH}{\|}}{C}{-}NH{-}C_6H_4{-}SO_2{-}NH{-}C_6H_3Br_2\ (3:5).$$

Where R = phenyl, p-chlorophenyl, p-methoxyphenyl.

Compounds of the above type have been synthesised by reacting the sulphanidamides with the corresponding cyanoguanidines in pyridine medium having enough pyridine hydrochloride to allow the resulting beguanides to form hydrochlorides. None of the above compounds, tested so far showed any antiplasmodial activity.

### 142. Condensation of Trichloro-ter. isobutanol with substituted aromatic monocarboxylic acid chlorides.

(Km.) INDU GUPTA and T. D. TEWARI, Allahabad.

Condensation of trichloro-ter. isobutanol with substituted aromatic monocarboxylic acid chlorides has been carried out in presence of pyridine and the resulting esters are awaiting study of their insecticidal property.

### 143. Examination of the Oil of Squash Gourd.

P. C. GUPTA and R. D. TEWARI.

### 144. Chemical Examination of Ipomoea Hispida.

P. C. GUPTA and T. D. TEWARI.

### 145. Bromination of Compounds Containing Two Aromatic Nuclei.

Miss. U. N. HIRWE and G. V. JADAV, (Bombay).

The phenyl, o, m-, p—cresyl, α β -naphthyl and o- p-nitrophenyl esters of 2-hydroxy—3-methyl—5-nitro—benzoic acid, 2-hydroxy—4-methyl—5-nitro—benzoic acid, 2-hydroxy-3-nitro-5-methyl-benzoic acid and 2 : 4 dihydroxy-benzoic acid were brominated in acetic acid medium and with liquid bromine, when mono bromo derivatives and higher bromo derivatives were obtained.

The constitution of the bromo derivatives was arrived at by their hydrolysis in alkaline medium and in some cases the bromo derivatives have been synthesised.

### 146. Sesamin from Sesame Oil.

B. H. IYER and N. L. NARAYANAMURTHY, Bangalore.

With a view to studying the pharmacological properties of sesamin, one of the minor constituents of sesame oil, experiments were conducted to isolate this employing Tocher's method (*Pharm. J. Transactions*, 1891, *21*, 639) from a bazaar sample of the oil and also from oil extracted in our laboratories from sesame seeds (*Sesamum indicum*, Linn.). On an average sesamin has been isolated in 0.2 per cent yield on the weight of oil. Its analysis and colour reactions have been studied.

While sesamin has shown little activity against common pathogenic bacteria like *Staphylococcus aureaus*, *Streptococcus pyogenus*, *Bact. Coli* and *Bact. typhosum*, it has indicated activity against *Mycobacterium tuberculosis* even in 1 : 1,000,000 dilution (Gangadharam, P. R. J., Narayanmurthy, N.L., and Iyer, B.H., *Curr. Sci.*, September 1952).

The two samples of oil have been submitted to routine analyses and the results recorded.

### 147. The Structure of Gum from Drum-Stick Plant. Part II.

T. R. INGLE and B. V. BHIDE, Poona.

### 148. Chemical Examination of Gun Mokha. Part II.

T. R. INGLE and B. V. BHIDE, Poona.

### 149. Chemical investigation of Carissa carandas and Cylista Scariosa.

D. V. JOSHI, Bombay.

*Carissa carandas* whose roots are useful as stomachic and *Cylista scariosa* whose roots are being used as a remedy for dysentary, though abundantly available in India, have not been chemically investigated. The root-bark of *Cylista scariosa* has yielded tannins with little of sugar, while the inner part of the root has given an impure organic compound. The roots of Carissa carandas have also been similarly extracted. The extract was distinctly acidic. On chromatographing it through activated alumina, a product was obtained which separated as transparent needles, m.p. 111-12°. Further work is in progress.

### 150. Studies in the Fries Migration : The Fries Isomerisation of Different Esters of 2 : 6-dibromo-phenol.

G. G. JOSHI and N. M. SHAH, Ahmedabad.

In continuation of our work on Fries migration of various phenolic esters (Shah and Co-workers, J. I. C. S., 1946, *23*, 199; 235; 1948, *25*, 377; 1949, *26*, 235; 1950, *27*, 531; 1952, *29*, 255, 351), we have now extended this reaction to the investigation of 2 : 6-disubstituted phenolic esters. 2 : 6-dichloro phenolic esters were investigated (Tarbell and Fanta, J. A. C. S., 1943, *65*, 2169). We have now investigated the corresponding dibromo derivative. Our conclusions are in conformity with those of Tarbell and Fanta. The bromine atoms in two ortho positions to -(OH) are neither inhibitory for the migration nor are eliminated during the course of the reaction.

### 151. Reaction of Phenylmagnesiumbromide with 2-3-substituted 4-quinazolones.

I. K. KACKER and S. H. ZAHEER, Hyderabad.

In continuation of the work reported earlier (Proc. Indian Sc. Cong. Assoc. 1952, III, 102), later work showed that the solid products of the reaction of phenyl magnesiumbromide with 2-ethyl-3-phenyl-4-quinazolone (Product A) and with 2-ethyl-3-p-tolyl-4-quinazolone (Product B) are not 4-quinazolinols. The solid products A and B are formed, presumably by the rupture of the quinazolone ring with the elimination of one nitrogen atom as aniline in the formation of product A and as p-toluidine in the formation of product B. The assumption that the ring rupture takes place is supported by the molecular weight determination of the products A and B, the analytical values for the elements and also by the fact that the bye-products in the formation of A and B have been identified to be aniline and p-toluidine respectively, through, b.p. determinations, colour reaction with bleaching powder and aniline and acetyl-derivatives. Further, the two products A and B which in the earlier communication (loc. cit.) were mentioned to have very close m.p., on further purification melted at the same temperature (156-57°C) and show no depression in mixed melting point determination, and are hence identical. Their identity has been further confirmed through their reaction products with acetic anhydride being the same and so also their picrates and picrolonates.

The work on the constitution of this product is in progress.

### 152. Indigenous Cotton Seed. Part I: Proximate Analysis of Hyderabad Varieties and Oil Composition.

V. R HARWALKAR, K. T ACHAYA and S. A. SALETORE, Hyderabad.

Proximate analysis of representative local samples of Hyderabad cotton seed group them into two types—low-liner and high-linter. The former is characterised by (averages in brackets) lower residual lint (4.0 %), oil content (19.2 %) and seed index (5.54) than the other (probably of American origin introduced into India), which is characteristically fuzzy (13.2 %), had a high seed index (9.06) and oil content on a dry delinted basis (20.5 %) and is comparable with punblished American average Moisture content, though known to be dependant largely on external humidity and hence variable seasonally, is lower for the former than for the latter type. Hull and kernel contants are roughly the same. If figures for oil contents are reduced from a 'dry delinted' basis to a 'whole seed' basis the oil percentages even out considerably and become almost similar (averages, 17.0, 16.4 and 17.6 %) respectively for low-linter, high-linter and U. S. A. types).

Component fatty acid analyses by ester-fractionation methods following lead-salt separation appear to show markedly lower linoleic acid and higher oleic acid contents in the former type than in the latter, even though iodine values were not greatly different.

### 153. Dibromoacetophenones.

R. B. KANTI and K. S, NARGUND, Dharwar.

Dibromoacetophenones, which were required in connection with another synthetic work, have now been prepared by Friedel and Crafts' condensation of acetyl-chloride with dibromobenzenes using the conditions and procedure described by Kshatriya, Shodhan, and Nargund, (J. I. C. S. 1947, *24*, 373) for the preparation of dichloroacetophenones. The constitution of the dibromoacetophenones were proved by their oxidation to the corresponding dibromobenzoic acids.

3:4-Dibromoacetophenone, m.p. 64°C, formed oxime, m.p. 52°C and semicarbazone, m.p. 202°C.

2 : 4-Dibromoacetophenone, m.p. 68°C formed oxime, m.p. 165°C, semicarbazone, m.p. 206°C and phenylhydrazone, m.p. 130°C.

2 : 5-Dibromo-acetophenone, m.p. 60°C formed oxime, m.p. 155°C, and semicarbazone, m.p. 203°C.

### 154. Chalkones from Dibromoacetophenones.

R. B. KANTI and K. S. NARGUND, Dharwar.

The dibromoacetophenones described in the previous abstract have been condensed with anisaldehyde and piperonal to obtain the corresponding chalkones. The chalkones have been characterised by the bromine addition-prorducts. The reactivity of bromine in these products has been studied. It has been shown that bromine atom nearer the alkoxy phenyl nucleus is easily replaced by the methoxy group by heating with methyl alcohol.

### 155. Component Fatty Acids of Body Fat from Surmai.

Y. D. KARKHANIS and N. G. MAGAR, Bombay.

Fat was extracted from salted dry fish-Surmai (seer fish—Cybium Commersonni). The fat had the following chemical constants :—

| | |
|---|---|
| Iodine Value | 71.3 |
| Acid Value | 40.4 |
| Free fatty acids as oleic | 20.32 % |
| Peroxide No. | 513 |
| Unsaponifiable matter | 9.2 % |

The fatty acids obtained after saponification of the fat were then separated by low temperature crystallisation at —55° and —30°C with acetone and ether as solvents. Fractions with Iodine Value of 150.5, 91.9 and 6.0 have been obtained. Linoleic and Linolenic acid in 150.5 I.V. fraction have been estimated by alkali isomerization. Methyl esters of the remaining 2 fractions have been fractionally distilled.

### 156. Effect of Substituted Rings on Carbon tetrahedral Angle. The dissociation Constants of Ortho — and Para—Nitrophenyl Glutarnic Acids. Part I.

R. K KAUL and R C. KAPOOR.

### 157. Chemical Examination of the Mucilage from Bhendi Hibiscus Escenlentus.

G. M. KELKAR, T. R. INGLE, R, V. GHATI and B, V, BHIDE, Poona,

### 158. Studies in Sulphur Compound.

V. G. KULKARNI and G. V. JADHAV, Bombay.

The action of thionyl chloride in presence of finely divided copper on 2 hydroxy-5-methyl-acetophenone, 2-hydroxy-4-methyl-acetophene and α-naphthol yielded thioether (Monosulphide). The constitutions of these compounds were proved by the action of nitric acid on their derivatives.

The interaction of sulphur monochloride and sulphur dichloride on the above ketones and naphthol gave the same thioethers.

In the case of α-naphthol, however, it was observed that the thioether of α-chloronaphthalene was formed as a bye-product in the case of the reaction with thionylchloride and Copper. The yield of this thioether of chloro-naphthalene was more, when thionyl chloride alone was allowed to react with α-naphthol.

### 159. Preliminary Investigation of the Catalytic Cracking of α-Pinene.

J. C. KURIACOSE, JAMES VERGHESE and LOURDU M. YEDDANAPALLI, Madras.

α-Pinene was subjected to 'cracking' at temperatures 350° to 500° on a Houdry Synthetic catalyst, Type S-46. The gaseous products consist mostly of hydrogen, ethylene, propylene, butylene and iso-butylens. The best yield of olefinic gases occur at 500°; for every 15 ml of α-pinene cracked there result 173.2 ml ethylene, 636.5 ml propylene and butylene, and 456.8 ml isobutylene. The liquid products are mainly of aromatics, the maximum amount of unsaturates being 8.4 %. Distillation tests indicate that the bulk of the pyrolysate boils below 180°; toluene, m-xylene and p-cymene have been identified. The formation of the above gaseous and liquid products has been explained on the basis of a carbonium ion mechanism.

### 160. Bromination of 5-Hydroxy-4-Methylcoumarin and its Methyl Ether.

S. S. LELE and SURESH SETHNA, Baroda.

The most reactive position in coumarins towards bromination is generally the 3-position. Dey and Kutti (Proc. Natl. Inst. Sci. India, 1940, 6, 641) have however observed that in the bromination 8-methoxy coumarin the first bromine atom enters the 5-position. In view of this observation it was thought of interest to study the bromination of 5-hydroxy-4-methylcoumarin and its methyl ether. The monobromo product obtained in both the cases is found to be the 8-bromo product. The dibromo compound obtained in the case of the hydroxy coumarin is found to be the 6:8-dibromo compound for it gives a coumarilic acid derivative on heating with alkali. With excess of bromine the 3:6:8-tribromo compound was obtained in both the cases.

### 161. Studies on Para Amino Salicylic Acid Derivatives, (Dyes).

S. MAHAPATRA and S. S. GUHA SIRCAR, Cuttack.

A number of azo derivatives of P. A. S. are described. They were prepared, (1) by coupling some diazotised aromatic primary bases with the alkaline solution of P. A. S. (2) by coupling diazotised base with the methylol derivative of P. A. S in alkaline medium, (3) and by coupling the diazotised mercurated bases with P. A S. in acetic acid medium. The dyes were tested against E. Coli, Stephylococcus Aureus and Mycobacterium Phlei in the Kirschner's synthetic medium and activities varying from 1 : 20,000 to 1 : 450,000 observed. The toxicity of a few of the mercurated azo dyes were tested using isolated frog's heart, by the Kymographic technique

### 162. Preparation of N-substituted 2-amino Thiazoles.

G. N. MAHAPATRA and M. K. ROUT, Cuttack.

The present investigation deals with preparation of several N-substituted 2-amino thiazoles. Acetophenone has been condensed with the following phenyl thioureas (o, m, p tolyl thioureas; o, p chlorophenyl thioureas; beta-naphthyl thiourea; o, m, p-carboxy phenyl thiourea) in presence of iodine. The crude reaction products after removal of excess of iodine and ketone were boiled with water and to the portion insoluble in hot water concentrated ammonium hydroxide was added and the products were crystallised from alcohol. In some cases gummy products were obtained which were characterised by their crystalline acetyl and picrate derivatives.

### 163. A Modified Method for the Synthesis of N, p-Hydroxy Phenyl Glycine.

V. R. MALLIKARJUNESWARA, M. RAGHAVAN and P. C. GUHA, Bangalore.

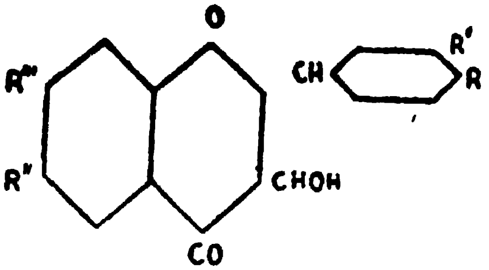
p-Hydroxyphenyl glycine, an important photographic developer and an intermediate in the manufacture of metol, is usually prepared by reacting p-aminophenol with monochloracetic acid. The reports of previous workers are either lacking in definite information regarding yields or describe too cumbersome a method for convenient preparation in the laboratory. The present paper describes a simple and convenient laboratory method for preparing p-hydroxyphenyl glycine in good yield from p-aminophenol and chloracetic acid. The results obtained by following the procedures of the previous workers are compared with those of the present modified method in a tabular form.

"The essential improvement of the modified method consists in activating the *p*-aminophenol remaing as hydrochloride in the usual reaction and making it react with an equivalent proportion of additional chloracetic acid by the alternate additions of aliquot portions of sodium carbonate and chloracetic acid upto the full amount of p-aminophenol remaining originally as hydrochloride, without the employment of a pressure-vessel referred to in the B. I. O. S. report No. 773. The yield of p-hydroxy-phenyl-glycine is thus raised from 16 % to 60 %."

### 164. Synthesis of Dihydro Flavonols and Flavonols. Part I : Formation of dihydro Flavonols.

M. G. MARATHEY, Poona.

The work of Murakami and Irie (Proc. Imp. Acad. Tokyo, *11*, 229, 1035) has been extended to the synthesis of substituted dihydro flavonols and the following dihydroflavonols have been synthesised from the corresponding o-hydroxy-chalkones.



| | | | | | | m.p. |
|---|---|---|---|---|---|---|
| (1) | $R = OCH_3$ | $R^{1} = H$ | $R^{11} = H$ | $R^{111} = H.$ | -- | 170° |
| (2) | $R = OCH_3$ | $R^{1} = H$ | $R^{11} = CH_3$ | $R^{111} = H.$ | -- | 160° |
| (3) | $R = OCH_3$ | $R^{1} = H$ | $R^{11} = COC_6H_5$ | $R^{111} = H.$ | -- | 220° |
| (4) | $R = OCH_3C_6H_5$ | $R^{1} = OCH_3$ | $R^{11} = CH_3$ | $R^{111} = H.$ | — | 156° |

It has been shown that the compounds obtained by the action of aqueous and 10 % $Na_2CO_3$ on chalkone dibromides of the type R.CO.CHBr. CHBr. $R^1$, where $R^1$ contains an alkoxy group in para position, are dihydroflavonols. If $R^1 = -C_6H_5$, no dihydro flavonols are obtained. The following dihydroflavonols have been prepared by this method in addition to the above mentioned four dihydroflavonols.

| | | | | | | m.p. |
|---|---|---|---|---|---|---|
| (1) | $R = OCH_2C_6H_5$ | $R^{11} = OCH_3$ | $R^{111} = H$ | $R^{111} = CH_3.$ | — | 173-174 |
| (2) | $R = OCH_2C_6H_5$ | $R^{1} = OCH_3$ | $R^{11} = H$ | $R^{111} = OCH_3.$ | — | 160° |

### 165. Synthesis of Dihydro Flavonols and Flavonols. Part II : Effect of substitutions in o-hydroxy or o-acetoxy-chalkone dibromides on the formation of dihydroflavonols.

M. G. MARATHEY, Poona.

The presence of a methoxy group in $6^1$-position in a chalkone dibromide has been found to offer a stearic hindrance to the formation of a dihydroflavonol or a flavonol from $2^1$-acetoxy-$6^1$ : 4-dimithoxy-chalkone dibromide and only the corresponding benzylidene coumaranone is obtained.

$2^1$-Acetoxy-$3^1$-methyl-4-methoxy-chalkone dibromide, m.p. 134°, I, and $2^1$-acetoxy-$4^1$-methyl-4-methoxy-chalkone dibromide, m.p. 125°, II, on treatment with aqueous acetone and 10 % $Na_2CO_3$ solution gave $4^1$-methoxy-8-methyl-dihydroflavonol, m.p. 168°, III, and $4^1$-methoxy-7-methyl-dihydroflavonol, m.p. 150°, IV, respectively. The dihydro flavonols III and IV on treatment with alcoholic alkali gave $4^1$-methoxy-8-methyl-flavonol, m p. 204°, V, and $4^1$-methoxy-7-methyl-flavonol, m.p. 180°, VI. The structures of the flavonols V and VI have been confirmed by their synthesis from 7 methyl-2-anisylidene coumaranone dibromide, m.p. 165°, VII, and 6-methyl-2-anisylidene coumaranone dibromide, m p. 175°, VIII, respectively, by the action of alcoholic alkali.

## 166. Structure of Ketha (Faronia Elephantum-Family Rutacae) Gum-Part I.

**G. P. MATHUR and S. MUKHERJEE, Kanpur.**

The gum obtained from a locally growing ketha tree, in the form of light yellow nodules was purified by repeated precipitation with alcohol. The purified gum obtained as white powder had sulphated ash 0.3 %; N, S and halogens absent; pentosans 30.6 %; pentoses 34.7 %; furfural 19.3 %. The gum is highly soluble in water and caustic soda solution, forming a light yellowish opalescent solution which is very sticky. The gum is non-reducing to Fehling's solution and did not give an insoluble copper salt.

Examination of a paper-chromatogram of the sugars produced by complete hydrolysis of the gum with sulphuric acid indicated the presence of galactose (Rf value 0o125) arabinose (Rf value 0.08), xylose (Rf value 0.15) and avery slow moving sugar which is glucuronic acid. The gum was subjected to graded hydrolysis.

## 167. Synthesis of Thiazole-2-amino-4-methylaminobenzoic-ethyl ester : A Pteroic acid substitute.

A. L. MISRA and J. D. TEWARI, Allahabad.

2-Amino-4-chloromethylthiazole hydrochloride has been condensed with benzocaine. The probable structure of the resulting compound has been assigned.

## 168. Synthesis of Thiazole-2-amino-4-methyl substituted Allantoin.

A. L. MISRA and J. D. TEWARI, Allahabad.

The condensation of allantoin with 2-amino-4-chloromethylthiazole hydrochloride has been carried out at 100°C in presence of dry pyridine. The probable structure to the resulting compound has been assigned.

### 169. Possible Anti-Tubercular Compounds. Part II, Preparation of Acyl Diphenylyl Amidines.

VINAY S. MISRA and MAHESHWARI P. KHARE, Lucknow.

In order to further increase the surface area and maintaining the lipoid solubility the following diphenylyl amidines have been prepared, starting from 4-amino-diphenyl, a compound of known anti-tubercular activity. The anti-tubercular activity of the amidines will be reported later on.

| | | |
|---|---|---|
| 1. | $4^1$-propio-N-4-diphenylyl-ortho tolyl-amidine | m.p. 125–130 C |
| 2. | $4^1$-propio-N-4-diphenylyl-meta-tolyl-amidine | m.p. 175–179 C |
| 3. | $4^1$-propio-N-4-diphenylyl-para-tolyl-amidine | m.p. 178–183 C |
| 4. | $4^1$-propio-N-4-diphenylyl-para-anisoyl-amidine | m.p. 180–182 C |

The amidines were prepared by following the elegant method of Oxley and Short (J. C. S., 1949,147).

### 170. Possible Anti-Tubercular Compounds Part III, Preparation of Acyl Diphenylyl Amidines.

VINAY S. MISRA and MAHESHWARI P. KHARE, Lucknow.

With a view to further increase the surface area and lipoid solubility of 4-amino-diphenyl, three $4^1$-butyro-diphenylyl-amidines have been prepared. The amidines have been prepared by the method described above.

| | | |
|---|---|---|
| 1. | $4^1$-butyro-N-4-diphenylyl-meta-tolyl-amidine | m.p. 148–153 C |
| 2. | $4^1$-butyro-N-4-diphenylyl-para-tolyl-amidine | m.p. 181–185 C |
| 3. | $4^1$-butyro-N-4 diphenylyl-para-anisoyl-amidine | m.p. 156–160 C |

The anti tubercular activity of the above amidines will be reported later on.

### 171. Structure of Neem (Melia Azadirachta Indica) Gum. Part II. Characterisation of Aldobionic Acid.

S. MUKHERJEE and H. C. SRIVASTAVA, Kanpur.

The structure of the aldobionic acid (I) obtained after the graded hydrolysis of the Neem gum has been established by methylation studies. On methylation of the aldobionic acid and hydrolysis of the methylated product (II), two methylated sugar residues are obtained: (i) a methylated galactose (III), (ii) a methylated uronic acid (IV). Methylated galactose was indentified by converting the sugar

**into a lactone (V) which crystallised and had a m.p. of 97° (M. P. of 2 : 3 : 6 — trimethylgalactofuranolactone 98°). The methylated uronic acid was oxidised with bromine and then esterified with 1 % methanolic hydrogen chloride when a lactone (VI) m.p. 106° was obtained. (M. P. of 2 : 3 : 4— trimethylglucosaccharopyranolactone, 107°).**

Mention was made about an unidentified sugar in the hydrolysate of the Neem gum in Part I of the series. This sugar has now been isolated with the help of cellulose column chromatography and from its $R_F$ value as well as from its methylphenylhydrazone derivative it has been shown to be fucose (VII).

## 172. Essential Oil from the Leaves of "-Premna Tomentosa."

M. S. MUTHANA and V. LAKSHMINARAYANA, Bangalore.

Essential oil obtained from the leaves of "Premna Tomentosa" (d$^{31.6}_{31.6}$ 0.8740 ; $[n]^{D}_{26}$ 1.4862 ; $[\alpha]^{D}_{26}$ (in $CHCl_3$) 31.41 ; Acid No. Nil ; Ester No. 8.9; Acetyl value 14.9 and Iodine value 75.1) was fractionated. Fraction II has been identified as d- and dl- limonene ; Fraction III as β-caryo-phyllene ; Fraction IV as a new sesquiterpene hydrocarbon to which a tentative formula is given ; Fraction V and VI have been identified as a new sesquiterpene alcohol and unidentified diterpene hydrocarbon respctivly.

## 173. Studies on *Annona squamosa (Linn.)* seed (sitaphal). Part IV, Its Toxic Principle (continued).

N. BHOJRAJ NAIDU, (Mrs.), Z. OSMANI and S. A. SALETORE, Hyderabad.

In continuation of previous work (Proc. Indian Sci Cons, 1952, Part III, Abstracts, p. 105), which reported the isolation of a crude toxic principle of high molecular weight, further purification has been attempted. The crude toxic matter was precipitated in 5.8 % yield from a mixture of *Annona squamosa* oil and low-boiling petrol ether (b.p. 40-60°C) maintained in ice and salt. This was separated into two main fractions with the help of a mixture of ether and petrol ether, the more soluble fraction (2.6 % on the weight of oil) containing the toxic principle, the insoluble part being free from toxicity. The work has indicated that the matter insoluble in petrol, previously reported as toxic by us and by Harper, Potter and Gillham (*Ann. appl. biol.*, 1947, *34*, 104) really consisted mainly of an impurity, probably a high molecular weight resin. The toxic matter which was the more soluble part, thus freed of the high molecular weight impurity, had a molecular weight of 322.1 and iodine value of 85, and was much more toxic than Harper's compound. The progress of the purification has been checked throughout by insecticidal tests.

## 174. Chemical examination of *Adansonia digitata* L. (Hindi Gorak imli ; Telugu, Simae-chintakaya).

N. BHOJRAJ NAIDU and S. A. SALETORE, Hyderabad.

The baobab or monkey bread tree, *Adansonia digitata* (Hindi, Gorak imli ; Telugu, Simae-chintakaya) is found scattered around Hyderabad state and in India in general, fruiting in March-April. The fruit pulp consisted of a hard, woody shell, containing a thin coating of friable white pulp over small kidney-shaped black seed weighing an average 0.16 gram each. The seed has a very tough black shell (28 %), and a soft kernel (72 %). The seeds are used as cattle feed and being rich in potash, should probably be used as manure. The decorticated seed on extraction gave 20.5 % of a golden-yellow oil (14.8 % on whole seed) with the following constants :—

Saponification equivalent, 291.2 ; Iodine value, 78.9 ; R. I. at 25°C, 1.4649. The fatty acids were separated by the Twitchell procedure into solid acids (33.3 %) and liquid acids (66.7 %), the composition of each of which is being examined.

The defatted cake, containing 4.5 % nitrogen, is similar to other oilseed cakes such as sitaphal or coconut.

### 175. Formylation of some Hydroxycoumarin Derivatives.

R. M. NAIK, V. M. THAKOR and R. C. SHAH, Bombay and Poona,

The hexamethylenetetramine method had been applied for the preparation of 8-formyl derivatives of 7-hydroxy-and 7-hydroxy-4-methyl-coumarins (Spath and Pailer, Ber., 1935, *68*, 941; Rangaswamy and Seshadri, Proc., Ind. Acad. Sci.. 1937, 6*A*, 112).

This method has now been successfully applied with slight modification to 5-hydroxy-4-methyl-, 5-hydroxy-4:7-dimethyl,-6-hydroxy-4-methyl-, and 7:8-dihydroxy-4-methyl-coumarins. The structures of 5-hydroxy-4-methyl-6-formylcoumarin, 5-hydroxy-4:7-dimethyl-6-formylcoumarin, 6-hydroxy-4-methyl-5-formylcoumarin and 7:8-dihydroxy-4-methyl-6-formylcoumarin have been provisionally assigned to the aldehydes obtained as they give coloration with alcoholic ferric chloride.

5:7-Dimethoxy-4-methyl-8 (or 6 ?)-formylcoumarin has been prepared in fairly good yield using N methyl formanilide in presence of phosphorus oxychloride, and characterised by the formation of 2:4-dinitrophenyl-hydrazone. Further work on the application of these methods to coumarin derivatives for preparing their aldehydes is under progress.

### 176. Synthesis of a Completely reduced analogue of Hexestrol : 1:2-Diethyl-1 (4-hydroxy cyclohexyl)-2 (4-isoamylcyclohexyl)—ethane.

(Miss) S. PARKHI and B. V. BHIDE, Poona.

The synthesis of 1:2-diethyl-1 (4-hydroxy cyclohexyl)-2 (-isoamylcyclohexyl) ethane, a completely reduced analogue of hexestrol, is described. Because of its structural resemblance to Calciferol, the compound is expected to possess antiractitic property.

### 177. Studies in Chalkones : Chalkones derived from quinacetophenone monethyl Ether.

C. C. PATEL and N. M. SHAH, Ahmedabad.

The work described in this paper relates to the chalkone formation from quinacetophenone monoethyl ether by its condensation with various aldehydes.

Kostanecki and his co-workers (Ber., 1901, *37*, 773, 2349 et seq) obtained by the condensation of the above monethyl ether with various aldehydes in presence of alkali, a 6-ethoxy derivative. Since then it has been taken for granted that only flavanones are obtained instead of the expected chalkones. We are now successful in obtaining the chalkones by adjusting the experimental conditions The chalkones obtained have isomerised to the corresponding known flavanones. Further work is in progress.

### 178. Synthesis of potential Amoebicidal Agents. Part I.

S. P. POPLI, NITYA ANAND and M L. DHAR, Lucknow.

Amoebicidal activity has been found to be associated with the quinoline molecule as also with its 8-oxy derivatives. Chloroquin (4-($\alpha$-diethylamino-$\delta$ methylbutyl)-amino-7-chloroquinoline) is a powerful agent for hepatic amoebiasis and Diiodoquin (5, 7-diido-8-hydroxyquinoline), Vioform (5-chloro-7-iodo-8-hyddroxy-quinoline) and Chiniofon (5-sulphonyl-7-iodo-8-hydroxy-quinoline) are active against intestinal amoebiasis. Various 8-oxy and 8-methoxy quinolines carrying an alkyl or aryl-amino side chain at the position 4 have now been synthesised with a view to test them against amoebiasis and to correlate amoebicidal activity with chemical constitution.

### 179. "Thiophenes and Thiapyrans. Part IX. Studies in the dehydrogenation of 1 : 2 : 3 : 4 — tetra-hydrodibenzothiophene."

K. RABINDRAN and B. D. TILAK, Bombay.

The dehydrogenation of 1 : 2 : 3 : 4 -- tetrahydrodibenzothiophene (I) was studied by using various dehydrogenating agents in order to prepare dibenzothiophene (II) in optimum yields under mild conditions. Dehydrogenation by means of selenium or palladized carbon gave good yields of (II), but the reaction was carried out at high temperatures ($<$ 275°). By employing N-bromosuccinimide the dehydrogenation could be carried out in a facile manner at low temperatures (76°). These results are of value in the synthesis of (II). Thus, whereas dehydrogenation of 1 : 1'2 (3'-chloro-2' : 1'-benzo) — 5 : 6 : 7 : 8 — tetrahydro-9-thiafluorene by treatment with selenium gave 1 : 2 benzo-9—thiafluorene by simultaneous dehydrogenation and dechlorination, dehydrogenation with N-bromosuccinimide gave the chlorine containing compound, 1 : 2 (3'-chloro 2' : 1'-benzo)-9- thiafluorene.

### 180. "Thiophenes and Thiapyrans. Part X. 1 : 2-Benzo-9-thiafluorene and 3 : 4-benzo-9-thiafluorene"

K. RABINDRAN and B. D. TILAK, Bombay.

The hitherto unknown angular benzo-9-thiafluorenes, 1 : 2-benzo-9-thia fluorene (I) and 3 : 4-benzo-9-thiafluorene (II) have been synthesized. The former was prepared starting from $\alpha$-thionaphthol and 2-bromocyclohexanone. Condensation of these compounds gave 2-(α-naphthylmercapto) cyclohexanone which on cyclization and subsequent dehydrogenation gave (I). The constitution of (I) was proved by its unambiguous synthesis starting from 8-chloro-1-thionaphthol and 2-bromocyclohexanone. Starting from β-thionaphthol, (II) was prepared by similar steps. The constitution of (II) follows from its nonidentity with 2 : 3-benzo-9-thiafluorene.

Absorption spectra of (I) and (II) were compared with the hydrocarbon isosters, chrysene and 2 : 4-benzphenanthrene.

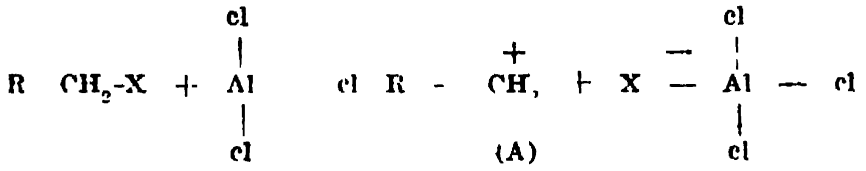
## 181. Mechanism of Alkylation Reactions.

CHITTARANJAN RAHA, Calcutta.

The alkylation of aliphatic or alicyclic systems having reactive hydrogen atoms is generally carried out in the presence of basic catalysts and that of aromatoids in the presence of acid catalysts though the formation of 'carbonium ions' is postulated as an essential step in both the cases. The fundamental similarity, in the postulated mechanisms for the two systetms, hints at the applicability of acid catalysts even in the case of non aromatoids.

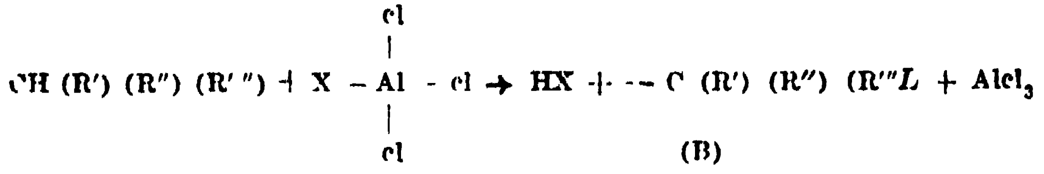
Actually acid catalyst like anhydrous aluminium chloride has been sucessfully used by the author for alkylating malonic ester with ethylene oxide or ethylene chlorhydrin, cyanoacetic ester and acetoacetic ester with α-haloacetate etc. The yield is always almost quantitative under proper reaction conditions.

On the basis of the postulated mechanism for alkylation of the aromatoids, the following generalised mechanism is suggested for that of the non-aromatoids in the presence of acid catalysts :

(1)


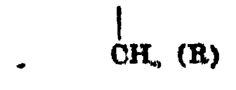
$$R\ CH_2\text{-}X + \underset{cl}{\overset{cl}{Al}}\ cl \quad R - \underset{(A)}{\overset{+}{C}H_2} + \overset{-}{X - \underset{cl}{\overset{cl}{Al}}} - cl$$

Where R = H,CH$_2$OH, alkyl, carbethoxy etc.

(2)


$$CH(R')(R'')(R''') + X - \underset{cl}{\overset{cl}{Al}} - cl \rightarrow HX + \underset{(B)}{\overset{-}{C}}(R')(R'')(R''') + AlCl_3$$

where R′, R″, R‴ are relevant groups or atoms.

(3)


$$A + B \rightarrow \underset{CH_2(R)}{C} - (R') - (R'') - (R''')$$

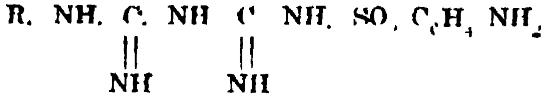
### 182. Some N$^1$—and N$^5$—substituted biguanides.

K. RAMAN, M. RAGHAVAN and P. C. GUHA, Bangalore.

Following the discovery of the unique antimalarial property of Paludrine (N$^1$-p-chlorophenyl-N$^5$-isopropyl-biguanide) by Curd and Rose (J. Chem. Soc., 1946, pp. 729) many attempts have been made to improve upon the activities of the parent drug.

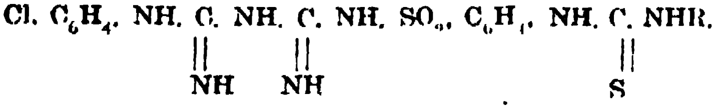
Considering that a suitable substituted biguanide system may be sufficient for antimalarial activity (Curd and Rose, *Nature*., 1946, *158*, 707), and also bearing in mind the versatality of the sulfanilamides in combating many kinds of diseases, we have prepared a series of compounds in which the isopropyl group is substituted by the sulfanilyl residue which is responsible for the chemotherapeutic activity in sulfanilamide type of compounds.

Twelve compounds of the type A and eight compounds of the type B were prepared and pharmacologically analysed.



$R.\ NH.\ \underset{\substack{\| \\ NH}}{C}.\ NH\ \underset{\substack{\| \\ NH}}{C}\ NH.\ SO_2\ C_6H_4\ NH_2$

Type 'A'



$Cl.\ C_6H_4.\ NH.\ \underset{\substack{\| \\ NH}}{C}.\ NH.\ \underset{\substack{\| \\ NH}}{C}.\ NH.\ SO_2.\ C_6H_4.\ NH.\ \underset{\substack{\| \\ S}}{C}.\ NHR.$

Type 'B'

***TYPE A.***

Where R = $ClC_6H_4$- (m.p. 178-9°), $BrC_6H_4$- (m.p. 198°), $IC_6H_4$- (m.p. 204°), $Cl_2C_6H_3$- (m.p. 175°), o-$ClC_6H_4$- (m.p. 180°), m-$ClC_6H_4$- (m.p. 170°), p-$NH_2C_6H_4$- (m.p. 160°), m-$NH_2C_6H_4$- (m.p. 154°), p-$CH_3C_6H_4$- (m.p. 192°), o-$CH_3C_6H_4$- (m.p. 188°), $\alpha$-$C_{10}H_7$- (m.p. 135°), $\beta$-$C_{10}H_7$- (m.p. 137°).

***TYPE B.***

Where R = $C_6H_5$- (m.p. 108°), $ClC_6H_4$- (m.p. 140°), Br. $C_6H_4$ (m.p. 132°), I.$C_6H_4$- (m.p. 138°), $CH_2 = CH$-$CH_2$- (m.p. 105°), o-$CH_3C_6H_4$- (m.p. 115°), m-$CH_3C_6H_4$- (m.p. 94°), p-$CH_3C_6H_4$- (m.p. 102°).

### 183. Interaction of Amino Compounds with Sodium Nitrite and Amyl Nitrite.

R. H. SAHASRABUDDHEY, RANVIR SINGH, and Miss V. ANKARAJU, Banaras.

A number of reaction mechanisms viz., (i) decomposition of Amine nitrite, (ii) interaction between amine cation and nitrous acid, (iii) reaction between amine cation, nitrite anion and a molecule of undissociated nitrous acid and (iv) decomposition of an intermediate diazonium salt, have been suggested for the usual amino group, nitrous acid interaction leading to the formation of the corresponding hydroxyl derivatives and notrogen. The present investigation was carried out with (a) thiocarbamide (b) acetamide (c) ammonia and (d) Methylamine in dilute acetic acid and sulphuric acid solutions (in dilute alcoholic media in the case of amylnitrite) In the case of amyl nitrite it has been observed that the reaction with (a) under all conditions is almost as fast as that between (a) and sodium nitrite, with (b), (c) and (d) in acetic acid medium the reaction is slower and about 3 3, and 10 cc respectively of gas is produced, in about 3 hours time from one milligram mole each of the reactants The major part of this gas is nitrogen (60-80 %). In sulphuric acid medium, from the same quantities of reactants the volume of gas evolved is 7, 1 and 12 cc respectively, which is almost wholly (over 80 %) nitric oxide From these observations it is clear that there is no fundamental difference in the nature of the reaction between amylnitrite, and the above compounds and that with sodium nitrite (Sahasrabuddhe J Ind Chem Sc 1950, *27* 515). What is more, there is not even much difference between the rates of reaction with amylnitrite and sodium nitrite with the above substances. When it is considered that the amylnitrite is not an electrolyte and is not likely to produce free nitrous anions and that it was used in dilute alcoholic medium which is not conducive to ionization, it may be concluded that its reaction with the above compounds takes place with the undissociated Et ONO and with the feebly positively charged amino groups.

### 184. Interaction of Bromine with Dimethylamine.

R. H SAHASRABUDHEY, Miss I. BOKIL and P. K RAMACHANDRAN, Banaras

By the action of dry bromine on an anhydrous solution of Dimethylamine in organic indifferent solvents like benzene, chloroform etc, two compounds A & B have been obtained depending on the quantities of reactants used. The 'A' which is deep red, corresponds to the composition Me,NH(H)$Br_3$, m.p. 74° ; only two thirds of its bromine has been found effective in liberating iodine, atom for atom, from potassium iodide, the occurence of which reaction at least partially in absence of any added external acid indicates that the third bromine atom is probably held as a part of HBr, i.e $Br^-$. The insolubility of the compound in most organic solvents further confirms its saline character. On boiling with alkali it liberates the theoretical quantity of dimethylamine as expectetd from the above perbromide structure The 'B' is deep yellow in colour and corresponds to the composition Me,NH, (H) Br, m p 91° (Norris, Am Chem J, 1898, *20*, 51-64); half of its bromine is reactive towards potassium iodide and the rest is of saline character i e. $Br^-$. On treatment with alkali it also liberates almost the calculated quantity (for the perbromide) of dimethylamine. The 'B' can be obtained from 'A' by the loss of an atom of bromine if the latter is left in a dessicator over sodium hydroxide

From the properties of these compounds there seems little doubt about their perbromide character ; the reaction of dry dimethylamine and bromine, therefore, appear to take place in two stages :

(1) $2\ Me_2NH + Br_2 \rightarrow Me_2NBr + Me_2NH, HBr$. and

(2) $Me_2NH, HBr + n\ Br \rightarrow Me_2NH, HBr_2$ or $Me_2NH, HBr_3$.

## 185. Chemistry of Aliphatic Thiocarbamides. Part II. N. N. Dimethylthiocarbamide.

R. H. SAHASRABUDHEY and RANBIR SINGH, Banaras.

Salkowski's method (Berichte, 1893, *26*, 2497) viz., isomerisation of dimethylamine-thiocyanate, proved unsuitable for the preparation of dimethylthiocarbamide. It was prepared by the condensation of dimethylcyanamide and hydrogen sulphide in presence of alcoholic ammonia. m.p. 161°.

Its hydrolytic decomposition was studied in acid and alkali. With normal and five normal sulphuric acid decomposition did not take place. However, with normal caustic soda, amine 28.9 % and $H_2S$ 6 % and five normal alkali, amine 41.1 % and $H_2S$ 57.7 % were obtained.

Desulphurisation of dimethylthiocarbamide with copper powder in absolute alcohol medium was 20 % and in benzene 82 % in an hour. Desulphurisation with alkaline cadmium sulphate was also investigated in water. No reaction took place in the cold even after keeping for 24 hours but also complete desulphurisation was observed in one hour in boiling solution.

Its interaction with nitrous acid was found to be analogous to that of thiocarbamide. Depending on the concentration of reactants and conditions of experiments dimethylthiocarbamide forms various complexes with silver nitrate. The compounds are stable only in presence of nitric acid. With a moderate excess of $AgNO_3$ at ordinary temperatures or in boiling solutions $(CH_3)_2N.\ CS.\ NH_2, AgNO_3$ is the principal product, while with a large excess of the reagent at ordinary temperature $(CH_3)_2N.\ CS.\ NH_2, 2AgNO_3$ is the main product. In the presence of very large excess of $AgNO_3$ or dimethylthiocarbamide no complex formation takes place.

On oxidation with various oxidising agents in an acidic medium, salt of the corresponding "formamidine disulphide" is obtained. Bromide m.p. 210°(d). Picrate m.p. 117°. Its interaction with nitrous acid and its iodine liberating capacity under the influence of various factors have been studied and are found to be closely similar to those of "formamidine disulphide." Molecular wt. values determined cryoscopically in water medium were 127, 125.3 and 137.4.

The interaction between aqueous dimethylthiocarbamide and iodine can be used for the titrimetric estimation of the former.

Acetic anhydride with $ZnCl_2$ as catalyst gives an acetyl derivative, m.p. 212°

## 186. β-Dichloro Phenyl Ethyl Amines.

P. B. SATTUR and K. S. NARGUND, Dharwar,

These compounds have been prepared with a view to test them for germicidal properties. The Dichloro-cinnamic acids described in the previous abstract were

**reduced to β -dichloro phenyl propionic acids. Hofmann reactions on the Amides of these acids gave -dichloro phenyl Ethyl amines.**

β-2 : 5 Dichloro phenyl propionic acid had had m.p. 93-94 and formed an amide m.p. 141. β -2 : 5 Dichloro phenyl ethyl amine had b,p, 215-220, It formed an hydrochloride which has no melting point, oxalate m,p, 195-6, tartrate m,p, 140, and picrate m.p. 195.

β -3:4 dichloro phenyl propionic acid had melting point 63-64 and formed an amide having b.p. 114. β -3 : 4 dichlorophenyl ethyl amine had b,p, 230-235, It formed a hydrochloride m.p, 212-15, benzoyl derivative m.p, 82, picrate m,p, 191, tartrate m.p. 188-190, and oxalate m.p, 206-8,

β -2 : 4 dichloro phenyl proponic acid had m.p. 76-77 and formed an amide m.p. 109-110. β -2 : 4 dichloro phenyl ethyl amine had b,p, 220-230, It formed hydrochloride m.p. 186, picrate m,p, 178-80, and benzoyl derivative m.p, 102,

### 187. Dichloro Cinnamic Acids.

P. B. SATTUR and K, S. NARGUND, Dharwar,

Dichloro cinnamic acids were required in connection with the preparation of β -dichloro phenyl ethyl amines. As the dichloro benzaldehydes were unavailable and difficult to prepare, we have used the condensation of maleic acid with diazotised dichloro anilines, following the procedure of Meerwin, Buchner, and Emster. (J. Prakt. Chem. *152* 237, (1939) and Rehun, Mathur (J. Ind. Chem. Soc. 1951, 540).

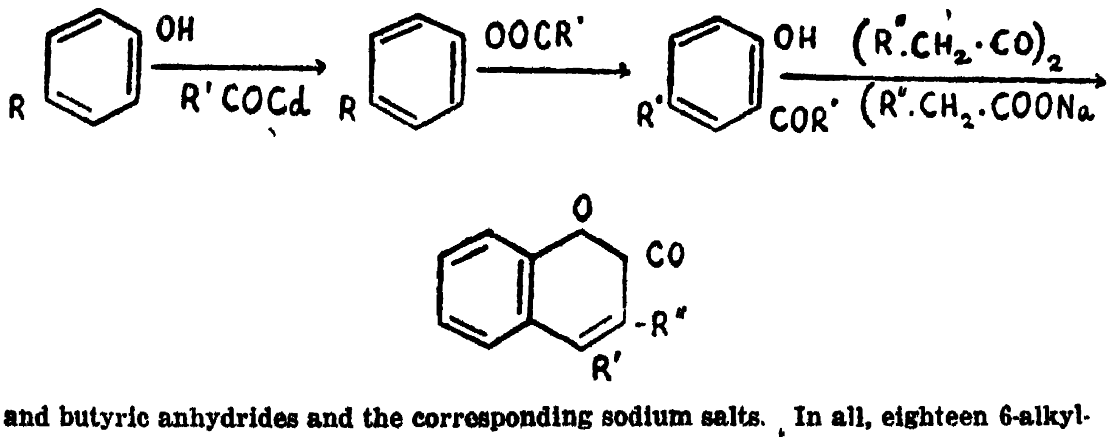
The Cinnamic acids thus obtained were the Cis acids and they were easily transformed into the trans acids by heating with a trace of bromine in chloroform solution. The characteristics of these cis-acids have been described. Cis-2 : 5 Dichloro cinnamic acid.

### 188. Kostanecki-Robinson Acylation. Part II, Studies in 5-alkyl-2-hydroxy-acetopherum.

A, B, SEN and T, N, KAKAJI, Lucknow,

In order to find out whether a p-tertiary alky group in the ortho-hydroxy-ketone had any influence during the Kostanecki-Robinson acylation in the formation of coumarins and chromones, six ortho-hydroxyketones were subjected to Kostanecki-Robinson acylation. It was found that in all these cases, coumarins were obtained.

The ortho-hydroxyketones, employed were prepared by the Fries migration of acetic, propionic and butyric esters of p-tertiary butyl and amyl phenols. These were then subjected to Kestanecki-Robinson Acylation employing acetic, propionic and butyric anhydrides and the corresponding sodium salts. In all, eighteen 6-alkyl-coumarins were obtained and the structure of these compounds was arrived at from the results of hydrolysis with 2N alkali.



R = Tertiary butyl and amyl groups
R = —$CH_3$ or —$C_2H_5$ or —$C_3H_7$.
R'' = —¾ —H or —$CH_3$ or ¾—$C_2H_5$.

### 189. A New Synthesis of Chloromycetin.

A. B. SEN and D. D. MUKERJI, Lucknow,

Starting with cinnamic acid, Chloromycetin has been synthesised. dl-α-Bromo-β-hydroxy-β-phenylpropionic acid was prepared in 85 % yield by the action of hypobromous acid on potassium cinnamate which in contact with technical ammonium hydroxide (sp. gr. 0.90) yielded dl-α-amino-β-hydroxy-β-phenylpropionic acid (Phenylserine) in 90 % yield. This compound was converted to Chloroamphenicol after the method of Gino Carrara and Gustavo Weinauer (C. A. Vol 44,1950 7268).

### 190. Search for New Insecticides Part A.

A. B. SEN and A. K. SEN GUPTA, Lucknow,

In the present paper the preparation of a number of alkyl ethers of chloro allyl phenols has been described. These ethers are expected to be good contact insecticides as they contain a neurotoxic halobenzene group and an ether linkage having lipophilic properties, the two main factors necessary for a good contact insecticides (Langer, Martin & Muller. Helv. Chem Acta. 1944, 27,892).

The halogenated allyl phenols were obtained by the rearrangement of the allyl ethers of 2-chloro, 4-chloro and 2:4-dichlorophenols in the usual way (Claisen, Ann. 401, 36, 1913). Methyl ethers were prepared in the usual way by alkylations with dimethyl sulphate and alkyl halides being employed in the case of ethyl and propyl ethers.

### 191. Corchorgenin—A New Cardiac Active Principle From Jute Seeds-*Corchorus olitorius*, Linn.

NIRMAL KUMAR SEN and JIBAN KUMAR CHAKRAVARTI, Calcutta.

A new cardiac active agent has been found in the seeds-Colitorius, collected from Chinsura, West Bengal. The ethanolic extract of the defatted seeds yielded raffinose about 2.5 %, a bitter stuff about 0.25 % and a small amount of resinous matter. From the bitter stuff by a developed method of chromatographic purification, a pure cardiac poison, m.p. 227°c (uncorr); $(\alpha)_D^{21} + 90°$ (ethanol) has been isolated. The substance is a genin as it could not be hydrolysed by the usual methods of hydrolysis. The genin has been provisionally named as 'Corchorgenin.'

The bio-assay of corchorgenin revealed its digitalis like action in the isolated hearts of frog and cat. A typical digitalis like action could be demonstrated with concentration of $5 \times 10^{-6}$. In cats mean lethal dose = 265·8 + 23·1 (S. E.) μg. per kg. In these tests 1 mg. of corchorgenin is equivalent to about 2 I. U.

### 192. Methyl 1-methyl-4-piperidone-3-carboxylate.

G. S. SIDHU and S, H. ZAHEER, Hyderabad-Dn,

Howton prepared methyl 1-methyl-4-piperidone-3-carboxylate (A) in poor yield by refluxing bis ( $\beta$-carboxymethylethyl) methyl amine (B) with powdered sodium in xylene until a homogeneous solution was obtained. We have noticed that on addition of (B) to sodium in xylene a pale yellow precipitate separates out. We filtered it and found it to be the sodio derivative of (A). It is formed in near quantitative yields and can be subsequently convertted into (A) by acidification (pH 6) followed by basification (pH 11) and repeated extraction with ether.

### 193. Chemistry of Aliphatic Thiocarbamides—Part IV. Tetramethylthiocarbamide.

RANBIR SINGH and K. R. SESHADRI, Banaras.

Tetramethylthiocarbamide is prepared by the direct thermal decomposition of tertramethylthiuramdisulphide (Sahasrabudhey, J. Ind. Chem. Soc., 1951, *28*, 341) which is raised to 180° in a R. B. flask in 1½ hours time. The tetramethylthio carbamide formed is extracted with hot water (50–60°). The compound after being crystallised with water and alcohol melted at 78°o b p. 245°.

### 194. Strychnine and Brucine: Dealkylation Products of Brucine.

BALDEV SINGH and S. H. ZAHEER.

Demothylation of brucine with anhydrous aluminium chloride yields a mixture of two substances. Separation can be effected by warming the mixture with alcohol when one of these (A) passes into solution leaving the sparingly soluble (B) as undissolved residue. Both A and B give red colour with aqueous ferric chloride solution and readily dissolve in sodium hydroxide solution.

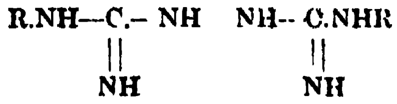
A has a melting point 255-256°C, its hydrochloride melts at 246°O and the acetyl derivative at 202-203°C. B on heating to 284°C chars and decomposes without melting, its hydrochloride remains unaltered on heating till 300°C and the acetyl derivative melts at 233-234°C.

On treatment with diazomethane solution in ether both A and B are converted back to brucine.

### 195. Some substituted Hydrazodicarbonamides.

K. S. SRINIVAS, S. S, GUHA and P, C, GUHA, Bangalore,

After synthesising and studying several types of biguanides, one of the main conclusions arrived at by Rose (J. C. S., 1951, 2782) is that a chlorophenyl residue, associated but not necessarily in conjugation with an amidine or extended amidine system and in a structure that provides the necessary Cationic function, will more often than not, lead to an active agent. And as the amidine systems have shown high antimalarial activity, it was thought of interest to synthesise and study the pharmacological action of the substituted hydrazodicarbonamidines. Accordingly, 8 compounds of the type A have been synthesised. The compounds have been prepared by reacting the respective cyanamides with hydrazine hydrate, hydrazine sulphate, and phenyl *hydrazine* in equimolecular proportions in the presence of pyridine and refluxing for 8-10 hours, and the different compounds have been isolated as their sulphates.



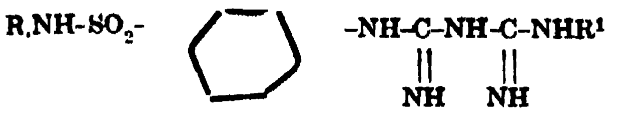
$$\mathrm{R.NH{-}\underset{\underset{NH}{\|}}{C}.{-}\,NH\quad NH{-}\underset{\underset{NH}{\|}}{C}.NHR}$$

Type A

### 196. Some N¹-sulphanilamido and sulphanilamido substituted-N⁵-alkyl Biguanides

K. S. SRINIVAS, S. S. GUHA and P. C. GUHA, Bangalore,

Previously, Bami, Iyer and Guha (J. Indian Inst. of Sci., 1947, *29A*, 15, ibid., 1948, *30A*, 1) have reported a number of sulphabiguanides of the type N¹-Sulphonilamido and sulphanilamido substituted-N⁵-aryl, some of which have shown activity against blood induced *P. gallinaceum* infection in young chicks, (Bami, Iyer, Guha, Curr. Sci., 1947, *16*, 386). They have shown some antibacterial activity also when tested *in vitro* against coccal infections (Bami and Natarajan, Curr. Sci., 1947, *16*, 156). Hence it was thought of interest to synthesise and study the pharmacological action of some of the N¹-sulphanilamido and sulphanilamido substituted-N⁵-alkyl biguanides, as possible antimalarials. Accordingly 16 compounds of the type A have been synthesised. The compounds have been prepared by reacting the sulphonamido cyanamides with the alkyl guanidine sulphates, in the presence of pyridine



Type A

### 197. Synthesis of 4-Phenyl-3:4-dihydronaphthalene-2:3-dicarboxylic acid.

R. K. SRIVASTAVA and J. D. TEWARI, Allahabad,

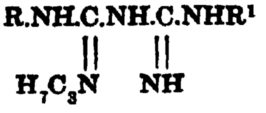
In this extension of Diels-Alder reaction, an ethylenic, dienophile (cinnamic acid) has been added to an acetylenic diene (phenyl propiolic acid) having the characteristic conjugated system of triple, single and double bonds,

$>C=C-C\equiv C-.$

### 198. $N^5$-sulphonamide derivatives of $N^1$-p-chlorophenyl-$N^2$-isopropyl biguanide.

S. N. SUR and S. S. GUHA, Bangalore,

Of the thousands of compounds studied in recent years for the discovery of an ideal antimalarial drug, only $N^1$-p-chlorophenyl-$N^5$-isopropyl biguanide (Paludrine) and sulpha derivatives have been found to be of any practical value. While the sulpha derivatives have little margin of safety, the action of paludrine is not intense enough. We have undertaken the synthesis of hybrids of these two structures to see if their properties could be reinforced in the same compound. Accordingly twelve $N^1$-aryl-$N^2$-isopropyl-$N^5$ sulphonamido biguanide derivatives of the type A have been prepared.



$$R.NH.\underset{H_7C_3N}{\underset{\|}{C}}.NH.\underset{NH}{\underset{\|}{C}}.NHR^1$$

Type A.

I R = Phenyl.
$R^1$ = (i) sulphanilamide (m p. 154°), (ii) sulphaguanido, (m.p, 166°), (iii) Sulphapyridyal (m.p. 152°), (iv) sulphathiazolyl (m.p. 174°), (v) Sulphamerazinyl (m p. 222°), (vi) sulphadiazinyl (m.p. 211°)

II. R = p-Chlorophenyl,
$R^1$ = (vii) sulphanilamide (m.p. 146°). (viii) sulphaguanido (m.p. 161°), (ix) sulphapyridyl (m.p. 136°), (x) sulphathiazolyl (m.p. 177°), (xi) sulphamerazinyl (m.p, 212°), and (xii) sulphadiazinyl (m.p. 227°)

All the above compounds were isolated as their hydrochlorides.

### 199. Chloramphenicol Series. Part I.

A V. SUNTHANKAR, B. D. TILAK and K. VENKATARAMAN, Bombay,

Synthesis of p-nitrophenyl α-diacetamido-β hydroxyethyl sulphone (III) a sulphone analogue of chloramphenicol has been undertaken. Several attempts to prepare p-nitrophenyl aminomethyl sulphone which is an intermediate in the synthesis of (III) proved unsuccessful. Similarly p-nitrophenyl phthalimodimethyl sulphone could not be hydromethylated. Thus the two routes which are successful in the synthesis of chloramphenicol could not be applied in the synthesis of its sulphone analogue. This was due to the deactivation of the methyl group in the aryl methyl sulphones.

Alternative routes to (III) through aryl nitromethylsulphides and sulphones are under investigation.

In view of the activity of p-nitrophenyl β -hydroxyethyl sulphide, sulphoxide and sulphone, several p-nitrophenyl substituted methyl sulphides, sulphoxides and sulphones and other related compounds were prepared. Several of these compounds are new.

### 200. Chemical examination of the seeds of Cassia alata; isolation of Colouring matter.

RAM DAS TIWARI, Allahabad.

From the seeds of Cassia alata, three colouring matters have been isolated. A yellow compound M.P. 194°, soluble in alkali was found to be $C_{15}H_{10}O_4$. This was found to be identical with Chrysophanic acid Another yellow colouring matter M. P. 187° was also alkali soluble. This was found to be $C_{13}H_8O_4$. A red compound M.P. 212° was found to be $C_{11}H_8O_4$, The exact constitution of these two compounds is being studied. Besides these two colouring matters, 2-methyl anthraquenone and protocatechuic acid have also been isolated.

### 201. Effect of Ring attached to Carbon atom by one of its valencies only on the tetrahedral angle.

L D TEWARI and J D TEWARI

### 202. Halogenation of Diphenylamine. Studies in the Diaryl Systems—Part I.

P S. VARMA. K, S. VENKATRAMAN and C. J. RAPHAEL. Banaras,

It has been reported that diphenylamine when brominated gives as the first product 2 : 4 : 2' : 4'-tetrabromo-diphenylamine, m.p 182°C. It was thought whether it would be possible to brominate diphenylamine in successive stages to get mono-, di- and tribromo-diphenylamines Even under careful conditions using less than molecular proportions of bromine the product was always found to be the tetra-bromo-compound along with the unreacted diphenylamine.

A di-iodo-diphenylamine, m.p. 129°C, obtained from diphenylamine, iodine and mercuric oxide in presence of alcohol described in the literature as x:x-di-iodo-diphenylamine (Classen D. R P. 81928; Frdl, *4*, 1095) has been shown to be 4 : 4'-di-iodo-diphenylamine as this on treatment with concentrated nitric acid at waterbath temperature gave 4 : 4'-dinitrodiphenylamine, m.p. 214°C, the presence of which was confirmed further by nitrating it to : 4 : 4'-tri-nitro-diphenylamine. Attempts to prepare this compound by the iodination of diphenylamine with iodine-monochloride in acetic acid soluton were unsuccessful

When 4 : 4'-di-iodo-diphenylamine was treated with bromine, iodine was displaced and 2 : 4 : 2' : 4'-tetra-bromo-diphenylamine was formed.

### 203. Halogenation of 2-Nitro-diphenylamine. Studies in the di-aryl Systems—Part II.

P. S. VARMA, K, S, VENKAT RAMAN and C, J, RAPHAEL, Banaras.

When 2-nitro-diphenylamine was reacted in acetic acid solution with chlorine, bromine and iodine monochloride, the halogen entered the 4'-position resulting in the formation of 2-nitro-4'-chloro-m.p. 146°C, 2-nitro-4'-bromo- m.p. 168°C and 2-nitro-4'-iodo- m.p, 173°C diphenylamines The 4'-chloro-and 4'-bromo-deriva tives have been obtained before by the condensation of p-chloro-aniline (Willberg Ber. *35*, 1902, 957 mm) and p-bromo-aniline with o-bromo-nitrobenzene (McCombie Scarborough and W.A, Waters, J. C, S, 1928, *I*, 353-359) The 4'-iodo-compound when treated with chlorine and bromine yielded 4'-chloro-and 4'-bromo-2-nitro diphenylamine and with nitric acid gave 2:4'-dinitro-diphenylamine m.p. 221°-22°C.

### 204. Halogenation add nitration of 2' : 4'-dinitro-2-methyl-diphenyl ether.

K. S. VENKATARRAMAN and U, RAMADAS NAYAK, Banaras.

The problem of orientation in diaryl systems of the type like diethyl, diphenyl ether and diphenyl oxide has attracted considerable attention of many previous workers. If a strongly ortho, para orienting group like the -OH or $-NH_2$ is present in one of the rings, further substitution takes first ortho and para to these groups in the same ring, while the presence of nitro group and halogens in one of the rings deactivates the ring and the substitution is heteronuclear. The present work gives the results of the orienting effects in nitrotolyl ethers.

In 2-methyl 2' : 4' dinitro-diphenyl ether, as one of the rings is deactivated the ether on halogenation and nitration gave the following 4-substituted products Chlorination and bromination in presence of iron, iodination by iodine monochloride and nitration by nitric acid and sulphuric acid yielded the following compounds. 2-Methyl-4-chloro m.p. 103°C, 2-methyl-4 bromo-m.p, 113°C, 2-methyl 4-iodo m.p. 94°C and2-methyl-4 nitro m.p. 129° 130°C 2' : 4-dinitro-diphenyl ethers. The positions of the halogen and the nitro groups were confirmed by preparing these compounds from the corresponding halogenated and nitro cresols and 2 : 4 dinitro-chlorobenzene. 2-Methyl-4-bromo-2' : 4' dinitro diphenyl ether on chlorination and nitration gave respectively chloro-bromo and nitro-bromo-derivatives and in these compounds the newly entering group from analogy with similar types of compounds of diphenyl ether is expected to be at position.

### 205. Halogenation and Nitration of 2'-nitro, 4'-nitro and 2' : 4' dinitro-4-methyl diphenyl ethers.

K. S. VENKATARAMAN and U. RAMDAS NAYAK, Banaras,

Chlorine, bromine, iodine and nitro groups enter in the 2-position in 4-methyl-2' : 4'-dinitro-diphenyl ether and the following compounds were prepared. 4-Methyl-2-chloro-m.p. 107°C, 4-methyl-2-nitro-m.p, 184°C, 2' : 4'-dinitro-diphenyl ethers were obtained. A few of these were also prepared starting from the corresponding p-cresols by condensation methods.

Substitution reactions in 4-methyl-2' nitro-and 4 methyl-nitro-diphenyl ethers also took place at position 2. The 4-methyl 2'-nitro-diphenyl ether has been reported to yield by Cook and Sherwood (J. A. C. S, 1915, 1936)' a bromo-product m.p, 28°C. A repetition of this experiment under similar conditions gave a mono-bromo-product m.p, 69°C. This was shown to be 4-methyl-2-bromo-2'-nitro-diphenyl ether. Similarly from 4-methyl-4'-nitrodiphenyl ether, 2 bromo-4-methyl-m.p. 80°C and 4-methyl-2-iodo-m.p. 88°C, 4'-nitro-diphenyl ethers were obtained.

Incidently the following compounds 4-methyl-2:6-dibromo-m.p. 141°C. 4 methyl-2:5:6-tribromo-m.p. 177°C, 4-methyl-2:6-di-iodo-m.y. 200°C and 2′-methyl-4′:6′-dibromo-m.p. 102°C, 2:4-dinitro-diphenyl ether were prepared by the condensation of 2:4- dinitro-chlorobenzene with the appropriate cresols.

### 206. Halogenation of Phenoxy-Acetic Acid.

K. S. VENKAT RAMAN, C. J. RAPHAEL and Miss M. K. PARUKUTTY AMRUA,

Banaras.

The halogen derivatives of phenoxy-acetic acids having a free o-position with reference to the-OCH$_2$COOH group have found use as plant hormones and weed-killers. Of these 2 : 4-dichloro-phenoxy acetic acid, popularly known as 2 : 4-D is being extensively used in agriculture. The present work gives the results of experiments on the systematic study of the halogenation of phenoxy-acetic acid. The optimum conditions for the preparation of 4-chloro-, 2 : 4-dichloro-, 2:4:6-trichloro- 4-bromo-, 2:4-dibromo-, 4-iodo- and 2:4-di-iodo phenoxy acetic acids are recorded. The preparation of 2:4:6-tri-iodo-phenoxy- acetic acids by direct bromination and iodination of phenoxy-acetic acid was not possible.

### 207. Preparation of mixed halogen phenoxy-acetic acids.

K. S. VENKAT RAMAN, C. J. RAPHAEL, and Miss M. K, PARUKUTTY AMMA,

Banaras.

Starting from the approximate halogenated phenoxy-acetic acids, by chlorinatingg, brominating and iodinating them, the following phenoxy-acetic acids were obtained. 4-Chloro 2-bromo- m.p. 138°C, 2 bromo 4 : 6- dichloro- m. p, 175°C, 4-bromo-2-chloro- m.p, 144°C, 4 bromo-2 : 6-dichloro- m.p. 196°C, 4-iodo-2 : 6-dichloro- m.p, 195°C, 4 chloro-2-iodo m.p. 138°C, and 4-bromo-2-iodo-m.p, 142°C phenoxy-acetic acids were obtained. These compounds and also 4-chloro-2 : 6-di-iodo- m.p, 185°C and 4-chloro-2 : 6- dibromo m.p. 75°C phenoxy acetic acids were prepared by condensing together the appropriate phenol with chloro acetic acid and chloro-ethyl acetate.

### 208. Halogenation and Nitration of 2 : 4 Dinitro-phenyl-1-Naphthylamine.

K. S. V. RAMAN, and S. K, ROY, Banaras,

2 : 4 Dinitro-phenyl-1-naphthylamine was prepared by condensing together 1-naphthylamine and 2:4-dinitro-chloro-benzene according to the known method (Ber., *23*, 3423-3430; J. Chem. Abs., 1891, *60*, 300)), On chlorination it gave a mono chloro-derivative, m.p. 187°-188°C; and on bromination gave a mono-bromo compound, m.p. 183°-184°C, The iodo compound on treatment with one molecule of bromine in acetic acid lost iodine and the bromo-compound obtained was identical with the one prepared by the direct action of bromine on 2 : 4-dinitro-phenyl-1-naphthylamine. The iodo-compound on trentment with nitro acid (d. 1.42) was converted to mono-nitro-compound, m.p, 205°, which was also obtained by the direct nitration of 2 : 4-dinitrophenyl-1-naphthylamine.

The position of chlorine, bromine, iodine, and nitro groups in these compounds are expected to be in the naphthalene ring, para to the secondary amino-group. The preparation of these compounds by condensing together the corresponding naphthylamines into 2 : 4-dinitro-chloro-benzene is in progress.

### 209. Bromination of β -Naphthoxy acetic acid.

K. S. VENKATRAMAN and K. P. SRIVASTAVA, Bananas,

β-Naphthoxy acetic acid prepared according to the method of C. F. Koelsch (J. A. C. S., 1931, *53*, 304) was brominated in glacial acetic acid successively to tri-bromo-m,p. 160–161°C, 1 : 6-bibromo- m,p, 178°C, and 1 : 4 : 6-tribromo- m.p. 224°C, 2-naphthoxy acetic acids. The position of bromine in these compounds was fixed condensing together the corresponding bromo-β -naphthols. With brom-ethyl acetate and hydrolysing the estlrs to the corresponding acids. The 1 : 6-dibromo compounds was also obtainable by the bromination of 6-bromo-2-naphthoxy acetic acid.

### 210. Iodination and Nitration of -Naphthoxy acetic acid. Studies in the Aryl-Oxy-Acetic acid Part—IV.

K. S. VENKATRAMAN and K. P. SRIVASTAVT, Banaras,

Attempts to iodinate β -naphthoxy acetic acid with iodine in presence of concentrated nitric acid got preferentially nitrated with the formation of 1-nitro-2-naphthoxy acetic acid m.p. 188—189° while with iodine monochloride in glacial acetic acid 1-iodo-2-naphthoxy acetic acid m.p. 170—171°C was obtained in satisfactory yields. This compound has been obtained before using iodine and iodic acid Efisio Mameli, Evaristo Gambetta and Guido Rimini (Gar., 1920, 501, 166—186d. The action of concentrated nitric acid did not give the expected iodo-nitro compound but the iodine was displaced and 1-nitro-2-naphthoxy acetic acid was obtained.

1-Nitro-2-naphthoxy acetic acid on bromination and iodination by iodine monochloride yielded 1-nitro-6-bromo m,p, 218—220°, and 1-nitro-6-iodo m,p, 230°, 2-naphthoxy acetic acids,

### 211. Halogenation of Dintro-Phenyl-β-Naphthyl Ethers.

K. S. VENKATA RAMAN and K, VISWESWARYA, Benaras.

2 : 4 Dinitro phenyl β -naphthyl ether, on bromination with one molecule of bromine in Acetic-acid solution gave, 2 : 4 Dinitro phenyl one Bromo β -naphthyl ether (M. P. 160°C) The position of bromine in this compound was fixed by preparing the same by condensing 1 Bromo β -naphthol and 2 : 4 Dinitro chloro benzene. Similarly 2 : 4 dinitro phenyl 1 chloro -naphthyl ether was obtained by chlorination. The 1 Bromo β -napthyl-dinitro-phenyl ether. On further by chlorination. The 1 Bromo -naphthyl-dinitro-phenylether, On further bromination in presence of Iodine as catalyst gave a dibromo β -naphthyl dinitro-chloro-benzene is also done. The M. P, is 150°C, This is in the further purification stage, This shows that second Bromine atom goes to 6 position in Naphthyl ring.

The halogenation and Nitration of 2:4 dinitro-phenyl -naphthyl ether and a few other nitro-derivatives are in progress.

### 212. Halogen absorption in ricinoleic acid,

S, VENKOB RAO. K. T. ACHAYA and S. A. SALETORE, Hyderabad Dn,

When halogens are allowed to act on an oil, they are absorbed, added and substituted with more or less violent reaction and evolution of halogen acid takes place. The reaction, moderated by using carbontetrachloride as solvent, was studied using ricinoleic acid, Bromine adds more or less instantaneously to the double bond with negligible sustitution, but chlorine adds to the extetnt of only 50 % even when present in excess. Side by side substitution is of the same dedgree as addition in spite of unsaturation still remaining.

### 213. Aromatisation of 3-Carene with Sulphur,

JAMES VERGHESE and LOURDU M. YEDDANAPALLI), Madras,

The effect of time, concentration and solvent on the type of reaction between halogen and ricinoleic acid has been studied. Catalyst like iodine and nitrobenzone have no catalytic effect on the reaction but pyridine results in withdrawl of halogen from the reacting medium.

The dehydrogenation of 3-carene to p-cymene with powdered sulphur alone and in combination with promoters such as anhydrous zinc chloride, active carbon, monochloroacetic acid and magnesium trisilicate has been *investigated,*

At temperature 170° to 190,° the peak conversion to p-cymene (14.92 %) resulted with 82 to 83 % of theoretical quantity of sulphur required by equation $C_{10}H_{16} + S \rightarrow C_{10}H_{14} + H_2S$. On increasing thte amount of sulphur beyond this critical quantity, a downward trend in the aromatisation is observed. Anhydrouss zinc chloride in conjunction with sulphur enhances the formation of p-cymene. The optimum transformation to p-cymene (13,69 %) is effected with 49 to 50% theoretical quantity of sulphur and 0.5g anhydrous zinc chloride, this being 1.19 % increment over the corresponding conversion with sulphur alone,

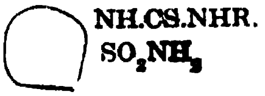
A combination of 1.25 moles of sulphur to 1 mole of 3-carene promoted with anhydrous zinc chloride, active carbon, or a mixture of these, gives 9 to 12 % p-cymene, not in agreement with the high yields (36 to 40 %) reported by Guha and co-workers (J, Ind. Inst. Sci., *26A*, Part 1, 1), Available data point to the fact that in sulphur dehydrogenation, excess of sulphur is deterimental. Monochloro acetic acid is less effectives as a promoter than anhydrous zinc chloride, and magnesium trisilicate appears to be a inhibitor in the aromatisation process.

### 214. $N^3$—substituted Metanilamides,

K. V. VISWANATHAN, M. RAGHAVAN, and P. C. GUHA, Bangalore.

The $N^1$-derivatives of 6-methyl metanilamide are claimed to be active against pneumocococal and brucella infections in patent literature (U. S. 2,299,555, Oct 20, 1942). The aryl sulphonyl thioureas are reported to have bactericidal and antimycotic properties. Some of these are endowed with antitubercular properties. (, A, 1948, *42*, 4202; Compt. Rend, Soc. Biol., 1945, *139*, 122-3; also 1943, *137*, 493-5). Simple thiourea in itself exerts a bacteriostatic effect proportional to its concentration in the culture.

In the light of the findings referred above, it was thought worthwhile to synthesise a series of N³-(substituted thiourea) derivatives of metanilamide listed below, as posible antitubercular, antimalarial and antibacterial drugs.



where R = (i) $C_6H_5$- (m.p, 161,5°), (ii) p-Cl$C_6H_4$- (m.p, 612.5—163°), (iii) p-Br-$C_6H_4$- m.p. 168.5°), (iv) p-I-$C_6H_4$- (m,p, 186°), (v) m-Cl-$C_6H_4$- (m.p. 181-2°), (vi) p-Tolyl- m.p, 160,5 to 161°), (vii) p-Xylyl (m.p, 156.5 to 157°), (viii) m-Xylyl- (m,p, 155-155.5°), (ix) p-Anisyl, (m.p, 155.5-5—156°), (x) *a*-Naphthyl, (m,p, 170°), (xi) Allyl; (m,p, 142-3°).

### 214A. Examination of *Calophyllum Inophyllum.*

RAJASHEKHAR C. BADAMI, Dharwar.

On a survey of the literature on *Calophyllum Inophyllum* it is found that most of the work done so far is on the oil from the seed-kernels and practically no work has been done on the composition of the non-fatty part of the seed-kernels and no work has been done on the local variety which is found to contain a very high percentage of oil (61-62 % of kernels).

In view of the high medicinal value and of the high oil-content of the seeds, the present investigation is undertaken.

The seed-kernels (75 gms.) were cut into fine pieces and extracted in a Soxhlet apparatus successively with various solvents, when the following percentages of extracts dried at 100°C. were obtained.

It has now been possible to establish directly the fused ring system ABCDE in rauwolscine by its Selenium dehydrogenation. By this process, rauwolscine producers an oxygen free base, Yobyrine (vi) $C_{19}H_{16}N_2$, m.p. 208° (Yield, nearly 35 % of the theoretical).

The m.p. of Yobyrine was found to be the same as that recorded by Karrer et al (Helv. Chim. Acta., 1952, *35*, 865) but differed from that obtained by Julian (J. Amer. Chem. Soc., 1948, *70*, 182), Witkop (Ann. *554*, 127), Clemo and Swan (J. Chem. Soc., 1946, 621) and Wibaut (Rec. Trav. Chem., 1949, *68*, 497), obtained from yohimbine by selenium dehydrogenation although the maxima and minima in the ultra violet spectra of Yobrine obtained from rauwolscine and yohimbine were practically the same as detailed below:

| | Maxima in the ultra violet spectra | Minima in the ultra violet spectra |
|---|---|---|
| Yobyrine from Yohimbine (M.p. 213-217) | 236, 289, 337, 350 m $\mu$ (Witkop) | 270, 301, 345 m $\mu$ (Witkop) |
| Yobyrine from Yohimbine | 237, 289, 327, 350 m$\mu$ (Julian et al) | 270, 300, 345 m$\mu$ (Julian et al) |
| Yobyrine from Yohimbine | 251, 290, 338, 350 m $\mu$ (Wibaut) | 250, 270, 300, 345 m$\mu$ (Vibani) |
| Yobyrine from Rauwolscine | 237, 289, 337, 350 m$\mu$ | 270, 299, 345, m$\mu$ |

The m. p. of yobyrine obtained from rauwolscine was not depressed when mixed with yobyrine prepared from yohimbine.

| | | |
|---|---|---|
| Petroleum ether extract | | |
| Ethyl ether extract | -- | 5.133 % |
| Chloroform extract | -- | 2.820 % |
| Ethyl acetate extract | -- | 1.666 % |
| Alcohol extract | -- | 4.529 % |
| Total | -- | 75.478 % |

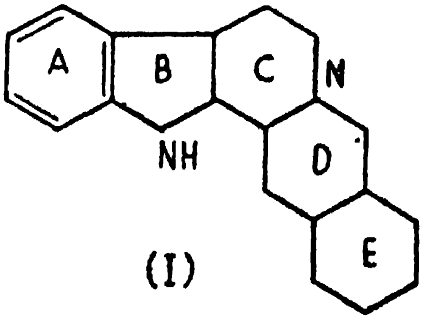
The alcoholic extract of the seed-kernels has been separated into various fractions and the constituents of the different fractions are under investigation.

The necessary statistical data for the economic utilization of this seed is being collected and it is also proposed to study the possibility of utilising this seed-oil for the manufacture of soaps, lubricants etc.

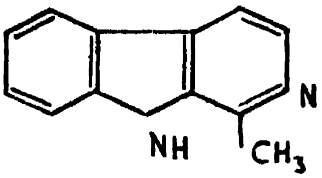
### 214B. Yobyrine—The Selenium Dehydrogenation product of Rauwolscine, the alkaloid of Rauwolfia canescens, Linn.

ASIMA CHATTERJEE (NEE MOOKERJEE) and SATYESH PAKRASHI, Calcutta.

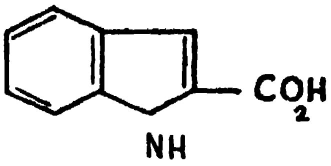
It was reported earlier (Chatterjee, J. Indian Chem. Soc., 1941, *18*, 33, 485; 1943, *20*, 11; 1946, *23*, 6; 1951, *28*, 29) that Rauwolscine, the alkaloid of *Rauwolfia canescens*, Linn., has the following structure (I):



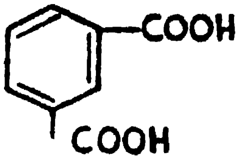
(I)



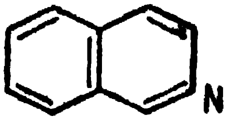
(II)



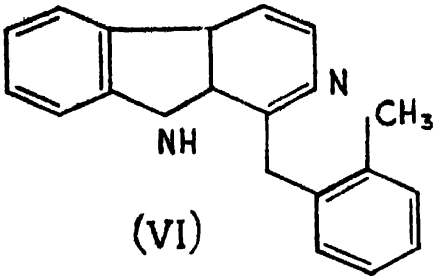
(III)



(IV)



(V)



(VI)

This structure was based on the facts that rauwolscine on degradation produces harman (II); indole-2-carboxylic acid (III), isophthalic acid (IV) and isoquinoline (v).

## BIO-CHEMISTRY

### 215. Studies on Vitamin A in Solution. Part VI. Stability in relation to concentration and chemical nature of vitamin A and solvents.

SUKHAMOY BHATTACHARYA, NARENDRA KUMAR CHOUDHURY and
U. P. BASU, Calcutta

In continuation of the previous work the stability of vitamin A in the form of alcohol, acetate and palmitate was studied in various solvents viz. olive oil, arachis oil, sesame oil and liquid paraffin at a concentration of about 20,000 I. U./g. with or without the presence of tocopherol, propyl gallate alone or in combination with citric acid or ascorbic acid. Results obtained by keeping these preparations at 37°C for about 500 hours show that all the systems containing no adjuvent lose more than 90 % of the vitamin A activity irrespective of the chemical form of vitamin A and nature of the vehicle. Esters of vitamin A keep better than the alcohol form when the system contains antioxidants. Tocopherol (O. 1 %) in vegetable oils shows practically no antioxygenic property but in liquid paraffin system it exhibits some keeping effect in the alcohol form of vitamin in vegetable oils shows good antioxygenic property which is further improved when propyl gellate is adjuvated with synergists like citric acid or ascorbic acid Effects of propyl gallate with or without synergists are of the above order with palmitate form of vitamin A in liquid paraffin. Results similar to palmitate are obtained with vitamin A alcohol in liquid paraffin. Results similar to palmitate are obtained with vitamin A alcohol in liquid paraffin but to a much less degree. No appreciable difference is noticed amongst the vegetable oils studied above so far as the behaviour of vitamin A is concerned.

Peroxide value increases very rapidly in all vegetable oil systems containing no antioxidant and in these systems tocopherol enhances the formation of peroxides to a much greater degree than the other adjuvents. Peroxide value in glyceride systems increases as vitamin A activity diminishes though there is no direct proportionality. Liquid paraffin systems with any form of vitamin A show slight peroxide formation.

### 216. Studies on Vitamin A in solution. Part VII. Effect of trace metals.

SUKHAMOY BHATTACHARYA, NARENDRA KUMAR CHOUDHURY
and U. P. BASU, Calcutta.

In part VI of this series it was observed that alcohol, acetate and palmitate forms of vitamin A lost about 90 % of their activity when present at 20,000 I.U./g.

and that citric acid or ascorbic acid in combination with propyl gallate showed good keeping property of vitamin A. Thus it was considered worthwhile to study the stability at lower concentration of vitamin A and to find out the function of the adjuvents in protecting its activity. The systems were studied with arachis oil medium.

Results show that at a concentration of 2000 I.U./g. when kept at 37°C for about 600 hours loss in alcohol form (90% loss) is similar to the previous study whereas acetate and palmitate forms lose about 60 % of their activity. Tocopherol which failed to protect vitamin A in glyceride systems at higher concentration, shows more or less good antioxygenic property at lower potency of vitamin A. Propyl gallate shows still better protecting capacity and citric acid exhibits similar results. Combinations of propyl gallate and citric or ascorbic acid does not further improve the stability.

Addition of iron (2 p.p.m.) and copper (0.2 p.p.m.) in vitamin A palmitate-arachis oil system show that both these metallic ions destroy the vitamin A potency very rapidly, copper being more destructive. Tocopherol protects the activity to a fair degree in case of iron but fails to do so with copper. Citric acid and propyl gallate individually keep the potency fairly well in both cases the effect being slightly better with iron than with copper. Combinations of propyl gallate and citric or ascorbic acid improves the keeping property further and the effect of metallic ions becomes completely nullified.

Systems containing no antioxidants or containing metallic ions develop peroxide very rapidly which is diminished to some extent by tocopherol and to a greater degree with gallate or acid synergists. The peroxide formation increases with decrease of vitamin A activity.

Acid synergists and to some extent propyl gallate seem to act as metal deactivators and helps in the protection of vitamin A potency.

### 217. Estimation of Nicotinic acid in Urine.

D. K. CHAUDHURI, Calcutta.

A method has been evolved which determines the nicotinic acid in normal urines as well as in urines containing a fairly large quantity of glucose. In this method digestion with conc HCl instead of strong alkali is found to be more suitable to get less coloured extract and then oxidation of the coloured extract and the oxidation of the coloured extract still in the waterbath with 4 % $KMnO_4$ renders the final extract almost colourless. This method can also be applied for the estimation of nicotinic acid in vegetables.

### 218. Nutritional Survey of Available Food Materials. Part IV. Availability of of Methionine, Cystine and Tryptophane in pulses.

The amino acids, methionine, cystine and tryptophane have been determined in the pulses—Bengal gram, Green gram, Lentil, Red gram, Black gram, Dried peas and Khasari by a modified chemical method and their availability was studied by feeding the weanling rats the respective pulses as the sole source of protein. Amongst the various pulses methionine content varried from 0.217—1.0 %, Cystine from 0·31°—0·69 % and tryplophene 0·86—1·25 % on the basis of protein. While the availability of S-containing amino acids varried significantly from pulse to pulse, hyptophene was almost completely available from all the pulses except from Red gram with less variation. The possible relationship of the amino acids availability with the biological value and growth promoting capacity of various pulses has been discussed.

### 219. Effect of Dietary Phosphorus on the Absorption and Utilization of Iron by rats.

JAGAT JIBAN GHOSH, Calcutta.

Of the different sources of phosphorus compounds that were fed to rats, previously made anæmic by Elvehjem and Kemmerer's technique, it was found that the phytic acid-supplemented diet had a less hæmopoietic effect than the lecithin or inorganic phosphorus supplemented diet. But so far as the storage of iron was concerned, it appeared from the values of the iron content of liver, spleen and of the whole body of rat that phytic acid did not interfere with the body-iron stored.

### 220. Studies on the Suppression of Mould Growth on Rice Grains.

JAGAT JIBAN GHOSH, Calcutta.

The suppression of mould growth on stored rice grains was tried by the fumigation method, using vapours of seven different chemicals of known fungicidal values. From the fumigation trial carried out with the vapours of ammonia, formaldehyde, acetaldehyde, ethylene dichloride-carbon tetrachloride mixture (E, D, C. T.), E. D. C. T, *plus* biphenyl, furfural and propionic acid, it was found that acetaldehyde, formaldehyde and furfural were most effective in bringing about inhibitory on any visible mould growth on rice. Contrary to our previous expectations, ammonia, ethylene dichloride-carbontetrachloride mixture (E. D. C. T.), E. D. C. T. *plus* biphenyl and propionic acid vapours were found to have no such remarkable retarding effect on the mould growth on stored rice grains.

### 221. Composition of Different Varieties of Plantains.

P. JANARDANA IYER, TRIVANDRUM,

A study of the Chemical Composition of the pulp of green matured plantain of different varieties available in Travancore, was made to serve as a basis in the analysis and grading up of Banana flour. The results indicate that the difference in chemical composition of the varieties is more of a qualitative nature and that it cannot be used as a sure means for identifying the varieties, especially when mixed. Microscopical examination was not of any help in identifying the varieties. The seasonal changes in composition was also not found to be significant.

The popular belief that the variety Nenthran has very high food value and that the variety Kannan has dietetic value specially suited for infants, growing children and invalids is not borne out by the results obtained.

### 222. Thiamine Riboflavin and Nicotinic Acid Contents of Some Marine Fishes of of Bombay.

(Miss) JOSHI S. M. and N. G. MAGAR, Bombay.

20 different species of marino fish of the catch from Bombay coast were analysed for their Thiamin Riboflavin and Nicotinic acid contents. Values for

Thiamin ranged from .1 ug/gm. to 1.1 ug/gm.; while those for riboflavin varied from 1.49 ug/gm to 28.4 ug./gm. Nicotinic acid content in different species was found between 6.0 ug./gm. to 4.9 ug./gm, Bombay Ducks (Harpodon Nehereus) because of its high moisture content was found to be very poor in these vitamins, where as Surmai (cybium guttarom) and Boya (Mugil parsia) were good sources of these vitamins.

### 223. Non-Protein Nitrogen Extractives of Fish from Bombay.

FRENY MASTER and N. G. MAGAR, Bombay.

10 species of fresh marine fish have been examined for the non-protein nitrogen fractions like trimethylamine, urea, uric-acid, creatine and creatinine. It is found that uric acid and creatinine are almost absent in fish. The values for trimethylamine nitrogen varied from 20 mg. to 60 mg. per 100 g. of fresh muscle tissue; and found about 8-16% of the total nonprotein nitrogen. Values for urea nitrogen ranged from 50 mg to 150 mg. per 100 g. muscle and contributed from 13 to 48 % of the total N. P. Percentage of creatine nitrogen varied from 23 to 57 %.

### 224. Microbiological investigations of the Acid peats (Kari Soils).

N. S. MONEY, Travancore-cochin.

The soils were examined for their bacterial activities namely, Ammonification, Nitrification and Nitrogen fixations. The soils show presence of ammonifiers. Nitrifiers are absent and attempts to inoculate fresh cultures resulted in failure. The soil extract is highly detrimental to nitrifying bacteria.

Azotobacter was isolated from Travancore acid (Kari) soils having a range of reaction of pH 2.5 to 4.5. It could be isolated on media commonly used for the isolation of Azotobacter. It has a size of 3.5—7 ps as against 0.5 to 1.2 x 1.7—2.7. ps for az. indicum, Starkey and 5—6 to 2—3 ps for the other species. One characteristic feature which distinguishes it from the acid-tolerant Az. indicum Starkey is its good growth on media supplied with $CaCO_3$. It grows equally well on media free from calcium carbonate. It develops well in nitrogen-free liquid and solid media from the acid limit pH 2.5 to 8.5 utilising mannite, sucrose, glucose and lactose. The organism fixed on an average 21 mgs. of nitrogen per gram of mannite. The organism is peritrichious, highly motile and diplococcoid.

The unusual tolerance of the new organism to extreme conditions of soil acidity and its easy isolation differentiate it from any of the previously known species of Azotobacter and even from the acid-tolerant Az. indicum.

### 225. Studies on Alloxan Diabetes. 1. Increased Susceptibility by Acetoacetate.

M. C. NATH, J. S. GADGIL, and V. G. HATWALNE. Nagpur.

1. Rabbits injected (intraperitoneally) with sodium acetoacetate for 5 weeks in the daily dose of 150 mg/kg. cause slight rise in blood sugar, but enormous fall in blood GSH.

2. The susceptibility of these treated animals to alloxan is increased to a great extent, 75 mg/kg. being the diabetogenic dose and 100 mg/kg. as the lethal dose.

### 226. On the Oxidation and Hydrolysis of the Condensation Product of Glucose and Ethylacetoacetate.

M. C. NATH and V. K. SAHU, Nagpur.

To explore the nature of the metabolic relationship between glucose and acetoacetate, which has already been observed by the authors to exist in the living body, the condensation product of the two, prepared and crystallised, was oxidised by alkaline hydrogen peroxide and its oxidative products studied. The oxidation reveals the formation of a bisulphite binding substance—a ketone, whose semicarbazone has a melting point of 248°C. It also shows the formation of the acetone body (acetoacetic acid) only at the higher alkalinity of alkaline hydrogen peroxide. Further, the hydrolytic effect of HCl studied on the same shows the formation of a reducing sugar, acetone, carbon dioxide and alcohol.

### 227. Studies in Enzymolysis. Part I. Effect of Ricinus lipase on Vegetable Oil.

C. J. PHILIP and T. A. RAMAKRISHNAN.

Ricinus lipase was prepared essentially by the method of Longenecker and Haley (1). The course of the action of lipase is governed by

(1) Presence of free fatty acid
(2) pH of the solution
(3) Volume of buffer
(4) Weight of lipase.

The activity is most marked during the initial stages of the reaction and gradually slows down until it becomes practically constant. The time interval for reaching the maximum hydrolysis is specific and definite for a particular fat.

### 228. Studies in Enzymolysis. Mineral content and Physiological action of Ricinus lipase.

C. J. PHILIP and T. A. RAMAKRISHANAN.

No reference with regard to the mineral content of Ricinus lipase is available. The following table represents data obtained with regard to its inorganic constituents.

| | |
|---|---|
| Ash | 7.96 % |
| $Fe_2O_3$ | 0.08 % |
| CaO | 0.19 % |
| $Mn_3O_4$ | 0.05 % |
| MgO | 1.62 % |

| | | | | | |
|---|---|---|---|---|---|
| $P_2O_5$ | -- | -- | -- | -- | 3.98 % |
| $K_2O$ | -- | -- | -- | -- | 0.29 % |
| $Na_2O$ | -- | -- | -- | -- | 0.13 % |
| $Al_2O_3$ | -- | -- | -- | -- | 0.04 % |

The proteins were also found to be 7.1 %.

The presence of Manganese shows that the protein may be a mangano-protein which is not usually found in seeds. There is a fairly good amount of protein. The lipase is very sensitive to some individuals and that too at certain times. However, it is not allergic to some individuals.

### 229. Vitamin $B_{12}$ Content of Livers of Different Animals.

G. B. RAMASARMA and K. G. SHENOY (Bombay)

Employing a turbidimetric adaptation of the vitamin $B_{12}$ activity assay of U. S. P. XIV, 3rd Supplement, the vitamin $B_{12}$ content of livers of different animals was determined.

Different extraction procedures were studied and consistently high values were obtained by digesting homogenized liver tissue with pancreatic extract at 50°C. for 1 hour followed by the addition of sodium metabisulphite (1 mg/ml) and heating at 80°C. for 15 minutes. Higher values were obtained with the addition of metabisulphite than without and this confirms the observations of Loy and others.

Using these methods the following values for the vitamin $B_{12}$ content of different animal livers were obtained : (in micrograms per gram of wet liver tissue) :

Ox (cow) : 1.0 to 1.2; buffalo : 1.2; goat : 1.2; sheep : 1.2; rabbit ; 0.6; rat : 0.05 ; mouse : 0.2; Bombay Duck (a kind of fish): 0.8; chicken : 0.2; pig : 0.6.

### 230. Stability of Vitamin $B_{12}$ in Liver Extracts.

G. B. RAMASARMA and K. G. SHENOY, Bombay.

A rapid destruction of vitamin $B_{12}$ activity in 72 % alcoholic filtrates of aqueous liver extracts stored at room temperature has been observed.

This destruction could be prevented by the addition of sodium metabisulphite.

Some evidence was obtained to indicate the existence in aqueous liver extracts of a vitamin $B_{12}$-—protective factor which is insoluble in 72 % alcohol. The vitamin present in unfractionated aqueous liver extracts and proteolysed liver extracts was found to be very stable.

The findings have been discussed in the light of available knowledge concerning the natural and artificial forms of vitamin $B_{12}$.

### 231. Mechanism of Destruction of Carotene in Oils.

B. R. ROY, Calcutta.

Carotene was added to crude, refined and hydrogenated oils and examined for its keeping quality after different periods of storage at 73°C. It is most stable in the hydrdogenated oil and least in the refined oil. Rate of reaction curves of carotene destruction in the oils appear to be characteristic of a chain or an antocatalytic reaction, but actually it is not and it was found to be due to the super-imposed effect of the peroxides which catalyse carotene loss and which themselves are formed in chains. Protection to carotene added to oils cannot be very effectively realised by the use of antioxidants unlike the great protection antioxidants afford to the oil. Amongst some of the antioxidants used, ethyl gallate is found to be the best. Destruction of carotene in an inert solvent such as iso-octane does not appear to be a chain reaction and is also not subject to appreciable antioxidant inhibition. Acid value and iodine value of the carrier oil do not change proportionately with decrease of carotene, but peroxide value appears to do. Oil with the highest initial peroxide value keeps carotene least and that with the lowest initial peroxide value does most. Highly potent linoleate peroxide isolated chromatographically on alumina loses carotene more in iso-octane solution than peroxide-free methyl linoleate. The action of peroxides on carotene is found to be catalytic. Carotene appears to act as a weak antioxidant for the oil to which it is added, but bleached carotene is a pro-oxidant which acts on the oil catalytically.

### 232. Studies on the biosynthesis of Ascorbic Acid.

S. C. ROY, N. C. GANGULY, G. Chatterjee, Calcutta

The rat can synthesise ascorbic acid in course of its normal metabolism This synthesis is greatly stimulated under narcotics, particularly, chloretone and results in an enhanced urinary excretion of the vitamin by the animal. This enhanced excretion under chloretone can be very nearly suppressed, if the animals are made pantothenic acid deficient. Chloretone also brings about a disturbance in the phosphorylating mechanism of the rat with the result that less phosphorylated intermediaries such as glucose-1-phosphate etc. are formed in the liver tissue of the chloretonised rats.

### 233. Microdetermination of Selenium.

SIULI RUDRA and M. N. RUDRA, Laheriasarai.

Ascorbic acid reduces selenite and selenates in the cold. This property has been utilised for a turbido-Colorimetric method of Selenium assay in soil, water and foodstuffs. The method is very simple rapid and accurate. Lathyrus sativus is very rich in selenium which is the toxic factor producing lathyrism.

### 234. Alpha and Beta Amylase Activities of Control and Vernalised Seeds of Wheat and Barley.

B. SEN and D. K, VERMA, Almora,

To find out the biochemical changes induced during the process of vernalisation, alpha and beta amylase contents of wheat and barley seeds chilled for different periods, (at 2° to 5°C°,) and of control seeds germinated at room temperature (24° to 26°C.) to similar coleoptile lengths were determined. Wheat, Pb. 228, and Barley, C. 293, which gave very good vernalisation response, were used for these experiments.

(*i*) No alpha-amylase could be detected either in wheat or barley chilled for one week or in controls of similar coleoptile length (1 to 2 mm). In the second week and onwards (Coleoptile lengths above 3 mm) alpha-amylase went on increasing up to the fifth week (6 to 8 mm coleoptile length). In all estimations, alpha-amylase content in chilled seeds was higher than in the corresponding controls. The maximum difference of over 900 % was observed in seeds chilled for two weeks in the case of wheat and of over 500 % in seeds of barley chilled for 3 weeks.

(*ii*) Except in the case of Pb. 228 wheat seeds chilled for 4 weeks, the beta-amylase activity of wheat and barley seeds chilled for different periods was higher than that of seeds of similar coleoptile lengths grown at room temperature.

(*iii*) The alpha-amylase activity progressively increased with increased period of chilling, but after three weeks of chilling beta-amylase activity diminished progressively in seeds of both wheat Pb. 228 and barley C 293

This investigation was undertaken in connection with the I. C. A. R, scheme on Plant Physiology and Cytology.

### 235. Effect of Cations and Phenoxy Compounds on the Elongation of Pollen Tubes.

B SEN and GYANDENDRA VERMA, Almora.

Effects of microconcentrations of Boron (as Boric acid), Manganese (as Manganese sulphate), Calcium (as nitrate) and Potassium (as nitrate) and of macro-concentrations of nitrates of calcium and potassium on the germination and elongation of pollen tubes of Sweet Pea (*Lathyrus odoratus*) and Madonina Lily (*Lilium candicum*) were observed.

The maximum stimulating effect of the above cations was observed when present in the following concentrations in the germinating medium (12.5 % ducrose):—B.—12 p.p.M.; Mn.—0,075 p.p,m,; Ca $(NO_3)_2$—1.7 p.p.m,; $KNO_3$—3.9 p.p.m.

The observed lengths of the pollen tubes of Madonna Lily after germination for 24 hours in the optimum concentrations of the different cations and phenoxy compounds in the germinating medium were: B.—5,366 μ; Mn.—4568 μ; Ca.—3538 μ; K.—3,700 μ; 2,4-D—3,534 μ; OCPPA—3.496 μ; TIBA—3146 μ; 2,5, DBA—2.728 μ; NAA—2,532 μ; PCPPA—2,156 μ; Control (21.5 % sucrose)—2,156 μ .

To study the effect of microconcentrations of K. and Ca. the sucrose content of the germinating medium was appropriately reduced to make the osmotic pressure equivalent to the control, i.e., 12.5 % sucrose. When macroconcent rations of K—M/33.3 and M/66.6 $HNO_3$ were incorporated in the germinating medium, the pollen tubes burst soon after germination, while Ca $(NO_3)_2$ M/20 to M/240 produced increased germination and greater elongation of the pollen tubes.

Viscosity of the streaming protoplasm in the tubes of pollen grains germinated in optimum stimulating microconcentrations of Ca and K was determined by measuring the velocity of single particles of streaming protoplasm in the pollen tube. It was found that Ca increases and K decreases the viscosity of the protoplasm.

The investigation was undertaken in connection with the I. C. A. R. scheme on Plant Physiology and Cytology.

## 236. Effect of Different concentrations of Colchicine on the Germination and and Elongation of Pollen Tubes.

B. SEN and GYANENDRA VERMA, Almora.

Effect of colchicine in microconcentrations on the growth of pollen tubes of Sweet pea (*Lathvrus odoratus*) and Madonna Lily (*Lilium candium*) was observed. The concentrations tried were: 500, 100, 10, 1, and 0.1 parts per million of colchicine in 12.5 % sucrose. From results of over fifty experiments it was found that concentrations above 100 p.p m, were toxic, in as much as germination was inhibited and pollen tubes formed were short and stubby Germination of pollen tubes was not inhibited at lower concentrations. The optimum concentration of colchicine which stimulated maximum growth as compared to control was found to be 1. p. p. m. in case of Sweet pea and 0,1 p,p,m, in case of Madonna Lily.

By measurements of velocity of single particles of the streaming protoplasm of hte pollen tubessit was found that presence of 0.1 p.p.m, of colchicine in the germinating medium decrease the viscocity of the protoplasm in the pollen tubes of Madonna Lily

This investigation was undertaken in connection with the I.C.A.R. scheme on Plant Physiology and Cytology.

## 237. H. E. T. P., T,E,P,P, Sprays and Parathion, Lindane, DDD and DDT Dusts for Pea Aphid Control with Special Reference to Pine Oil and other Solvents as Synergists for DDT.

A. S. SRIVASTAVT,

Department of Economic Entomology, University of Wisconsin, Madison.

A number of dusts and sprays were tried on a field scale for the pea aphid control on the pea vines. DDT dust in combination with 2 % pine oil or other solvents proved very effective; 1 .% gama dust was equally effective ; 0.5 % parathion and 0.5 % DDD dust also gave very high control. Pine oil particularly in combination with DDT showed synergism. HETP (½ pint in 100 gallons of water) and TEPP (⅓ pint in 100 gallons of water) as sprays gave 82 % and 94 % control of pea aphid respectively, but did not possess residual effect and also did not prove as effective as DDT dust in combination with pine oil or other solvents.

Grateful acknowledgement is made to Professor H F. Wilson for his valuable suggestions and guidance.

It is a pleasure to thank Dr W. B. Hull of Naval Medical Research Institute at Bethesda.

### 238. Comparative Contact Toxicity of α, βγ Isomers and Technical Benzene Hexa Chloride to the German Roaches.

A. S. SRIVASTAVA,

The contact action of technical benzene hexachloride (BHC) and its isomers α, β and γ was investigated against the German roaches, *Blattella germanica* Linn. The gamma isomer proved much more toxic than alpha or BHC The beta isomer was almost non-toxic. The application of insecticide was made by the help of 1 c.c. glass tuberculine injection syringe. Benzene hexachloride affected the roach most rapidly at the mesobasisternum region. The cause for the maximum sensitivity of this region might be due to the thin cuticle at this area and to the close location of the meso-thoracic ganglion to this region. It apears that as the ganglion was affected a spasmodic paralysis occurred all over the body particularly the appendages. Another symptom observed was the swelling of the abdomen of the roach and the stretching and the protrusion of the head If the swollen abdomen was submerged in water and pierced with a needle, two bubbles of a gas were evolved and soon after this the body resumed the normal form. The gas was found to be present in the midgut. The presence of gas would indicate that Benzene hexachloride was also affecting the respiratory or digestive system or both.

Grateful acknowledgement is made to Professor H. F. Wilson for his valuable suggestions and guidance.

## INDUSTRIAL CHEMISTRY

### 239. Study on Fischer-Tropsch Synthesis Mechanisms of Reaction. Part III.

G. C. BASAK and N. C. NIYOGI, Howrah.

Although the systhesis has been studied for nearly twenty-five years, manv aspects are not thoroughly understood. The fact that the metal constituents in the different catalysts like Ni, Co and Fe form carbides at lower temperatures and free carbon at higher temperatures has been proved by the work of Craxford and Rideal, Eidus and Zelenskii and Weller. Hoefer and Peebles proved the existence of $CO_2C$ by a study of X'ray diffraction pattern of a cobolt catalyst after treatment with CO below 200°C. It was also stated by Weller that carbon formed below 200°C was in combination with cobolt as carbide and that this can be hydrogenated rapidly at that temperature and also that ratio of carbon to cobolt was 0.1107 which corresponds to the formula $Co_2C$ but at temperatures higher than 250°C, the amount of carbon formed was much higher and that free carbon was formed which could only be hydrogenated at about 360°C. Hoefer and Peebles found from a study of X-ray diffraction of carburised catalyst sample, that above 275°C a mixture of cobolt and free carbon was present and there was no $Co_2C$ but at temperatures below 240°C a mixture of cobolt and $Co_2C$ was identified.

A weighed quantity of reduced cobolt catalyst was treated with CO at 190°C for 480 minutes and from the amount of $CO_2$ present in exit gases, the amount of carbon formed was calculated The carburised sample was then hydrdogenated and from the analyses of exit gases, the amount of carbon eliminated was calculated The results of the experiments show that carbon either in the free state or as carbide is formed and that the rate of formation of carbon is less than half of that at which it is eliminated by hydrogenation. Further experiments on the investigation of the nature of the reaction are in progress.

### 240. Recovery of Sulphur from Coals Rich in Sulphur.

G. C. BASAK, N. C. NIYOGI and B. CHATTERJEE, Howrah.

The present investigation has been undertaken to devise means of the recovery of sulphur as some inorganic sulphur compounds which can be utilised as a source of sulphur dioxide for the production of sulphuric acid.

For this purpose a sample of Assam coal was taken and subjected to low temperature carbonisation at 6000°C in an atmosphere of hydrogen, hydrogen saturated with moisture nitrogen, nitrogen saturated with moisture, and coal-gas.

The results show that nitrogen removes part of sulphur as hydrogen sulphide only upto a limit of 21 %, whereas pure hydrogen removes the same upto 71.8 %. Hydrogen saturated with moisture removes upto 66.6 % showing that moisture does not play any part and has a retarding effect on desulphurisation. Coal gas has also been found to have similar action as hydrogen

A special type of clay was tried as a catalyst during the experiments with hydrogen and nitrogen but without much success.

The progressive elimination of sulphur with time by the different gases has been shown. It is found that the removal of major part of sulphur takes place within first 3 to 4 hours and then it gradually decreases, the rate being exceedingly small after 12 hours of low temperature carbonisation.

The determination of sulphur in coal utilised in the experiments and cokes produced cannot be made by conventional Eschka method.

The nature of cokes produced and their sulphur contents are still under investigation.

### 241. Iron-Copper-Calcium Oxide Catalyst for the Fischer Tropsch Synthesis at Normal Pressure.

N. G. BASAK and B. S. SUBRAMANYUM, Jealgora,

Addition of magnesia and calcium oxide to cobalt catalysts for the synthesis of hydrocarbons by the Fischer-Tropsch Process have been found to increase the strength and prolong its life. The present investigation was undertaken to investigate whether increased yields of hydrocarbons could be obtained by adding calcium oxide to Iron-Copper catalysts.

### 242. The Preparation of Caloramines.

M. G. BHARGAVA, D. R. DHINGRA and G. N. GUPTA, Kanpur,

The dichloramine-T and Chloramine-T are cheap and active insecticides and germicides due to higher content of active chlorine. Further these compounds are also used in textile and laundry industries. Chloramine-T has been found of great value in pharmacy especially in cases of cerebrospinal meningitis, diphtheria, measles, scarlet fever and similar infectious diseases.

As the authors have studied the preparation of saccharine from Toluene, where para-toluene sulphon-chloride is a by-product, therefore the preparation of chloramines was taken up. In this paper the details of their manufacture have been given. Chattaway and Dakin's processes were used in their preparation. Para-toluene sulphonchloride was converted into the amide by treatment with ammonia and then treated with bleaching powder or sodium hypochlorite solution for making dichromine-T and Chloramine T.

### 243. Iron Catalyst for Fischer-Tropsch Synthesis at Atmospheric Pressure.

K. K. BHATTACHARYA and N. G. BASAK, Jealgora.

An Iron catalyst promoted by copper, magnesium oxide and potassium oxide has been develop for the Fischer-Tropsch Synthesis of Hydrocarbons at atmospheric pressure. The activity of the catalyst at different temperatures and at different space velocities have been studied and optimum conditions established. The effect of the adition of Kieselguhr as a carrier is also discussed.

### 244. Fatty Acids from Indian Cottonseed Oil Foots.

BHARAT BHUSHAN, Hyderabad-Dn. J. P. PHILLIPS and K. C. GULATI, New Delhi.

During the process of settling in the alkali refining of cottonseed oil, certain percentage of glycerides, free glycerine, almost all the colouring matter, and albuminous and mucilaginous constituents of oil are precipitated along with the soap formed by the action of alkali on free fatty acids present in the oil. This offensive smelling dark sediment is known as foots. Indian cottonseed oil is reported to contain a fairly high percentage of free fatty acids, colouring and albuminous matter. Consequently, this oil yields a much larger quantity of foots on refining—16-20 % as compared to 6-7 % from American oil. The sample of foots which has been investigated by the authors contained 66.24 % total fatty acids. In India foots is a waste product of our Industry. Attempts were therefore made to recover sufficiently pure fatty acids from this source. As a result of these investigations, a process has been worked out by which it is possible to recover practically colourless fatty acids in good yield (70.8 % on weight of total fatty acids in the foots and 46.9 % on weight of foots). Stearine pitch (25.6 % on weight of foots) was obtained as a residue.

### 245. Studies in Electro-osmosis of an Indian variety of Kaolin.

M, M. BISWAS, Calcutta.

Electro-osmosis of an Indian variety of Kaolin has been studied in presence of the electrolytes, NaOH, NaCl and $Na_2SO_4$. Current from 220 D. C. Main was employed and the working voltage was varied between 30 and 90 by change of electrical resistance of the circuit. The current remained practically constant at 0.5 ampere. A homogeneous mass of Kaolin has been obtained a good concentration of fine-sized particles. The presence of different ions as in NaOH, NaCl and $Na_2SO_4$ and change of electrical field have been found to influence the concentration of fine-sized particles to some extent though not in a remarkable way.

### 246. Studies in Fractionation of Yeast Invertase by Activated Alumina Gel.

M, M. BISWAS, Calcutta.

Brewers' yeast invertase solution was prepared, dialysed and precipitated at pH 4.6 with 50 % alcohol. The precipitate on centrifugalisation was dissolved in distilled water and the concentration of protein adjusted to 1.15 %. This invertase solution was treated with varying concentrations of activated alumina gel of 4.41 % $Al_2O_3$ and the adsorbed enzymes eluted with a buffer of pH 5.4. Behaviour of the eluted enzymes towards sucrose, inulin and raffinose as substrates on hydrolysis at 37°.4C was studied. It has been observed that inulin behaves specifically towards the enzyme solution and that adsorption of inalase reaches a maximum at a concentration of 4.5 c.c. (4.41 % $Al_2O_3$) alumina gel per 25 c.c. invertase solution after which it remains constant. Behaviour of the adsorbed enzymes towards sucrose and raffinose is normal.

### 247. An easy and rapid method for detecting mineral oil in mustard oil.

BRAHMA PRAKASH, A. C. GUPTA, and OM PRAKASH, Kanpur.

Of late there have been frequent complaints about the adulteration of vegetable oils with refined and deodourised mineral oils. At present the presence of mineral oil in vegetable oils is generally detected by the lowering of the saponification value of the oil and (or) by the determination of percent of unsaponifiable matter present in the oil. The original Holde's test is said to be a quick available method for the purpose. But as far as mustard oil is concerned, the method is not sensitive enough as experiments have shown that it does not detect less than 4 % of mineral oil in mustard oil. The method has, therefore, been studied with a view to make it more sensitive and the modification has been worked out and details have been given which can detect upto 1 % of mineral oil in mustard oil.

### 248. Anodic Oxidation of Methyl Alcohol.

P. S. DANGE and K. K. DOLE, Poona

A systematic study of anodic oxidation of methyl alcohol in aqueous sulphuric acid is carried out in a divided cell. The investigation at present is restricted only to the estimation of formaldehyde which is the main product of electrolysis. The conditions that are essential for the maximum current efficiency are obtained Low current density, low temperature and short period of working favour maximum current efficiency. Change of concentration of sulphuric acid or of alcohol has little effect on the current efficiency. Current efficiency of 90.00 % is obtained at 0°C. and at current density of 0.1152 amp. per sq. cm. duration of the electrolysis being 30 minutes.

### 249. The Decomposition of Ilmenite by Ammonium Sulphate.

G. S. DESHMUKH and D. K. PATWARDHAN, Banaras,

A simple but efficient method of decomposing Ilmenite by fusion with ammonium sulphate has been evolved. The powdered ore is mixed with ammonium sulphate in a ratio 1 : 10 and heated at about 350°C for 30 minutes. The fused mass is extracted with water and filtered. The insoluble residue is treated again with ammonium sulphate and the process repeated. It has been observed that in three operations about 80-85 % of the ore is readily brought into solution Optimum conditions for extraction of iron and titanium by the above process in a single operation are being worked out. It is considered possible to recover an appreciable quantity of ammonium sulphate utilized during the decomposition of the ore.

### 250. Acetylated Shellac-Cellulose.

A. N. DHAR, Patna.

Of late, mixed Cellulose organic acid esters have been gaining field. On grounds of certain reactive groups (Hydroxyl) present in shellac, the mixed acetylation technique was applied to shellac-cellulose, mixed up in different proportions. There results, on such a Chemical treatment, where, Shellac-Cellulose is 1 : 1 a light cream coloured composition of the following nature.

(1). Unattacked by dilute acids, alkalis and common solvents.
(2). Acetyl group 0, 85 % (while plain shellac acetate prepared in the same way was found to have this value as 0,65 % only).

(3). Has thermohardening tendency and the translucent molded articles possess fair qualities.

Further studies on the preparation of improved quality shellac-cellulose acetate are in progress.

### 251. Cast Cellophane Sheets from Cellulosic Wastes.

A. N. DHAR, Patna.

By pre-treatment of Bagasse, straw (rice) or Corn cobs (all 60 mesh) with dilute (4 %) Caustic Alkali in cold and later with steam injection, the elimination of lignin, sugars and wax (as the case may be) takes place. Purer form of Cellulose is obtained, which, when worked up by the usual xanthation method allows the manufacture of Cellophane paper on glass sheets, of almost the same quality as the one produced from cotton linters.

Suitable bath solutions, as required in the process, have been given.

Further studies to simplify and mechanise the process are in hand.

### 252. "The Electro-Polishing of Aluminium."

D. R. DHINGRA, M. G GUPTA and GIRISH C. JOSHI, Kanpur.

Electrolytically polished aluminium finds extensive industrial application in the manufacture of high quality reflectors and for other decorative purposes, hence it was proposed to investigate the details of the process which has recently been developed in the U. S. A. and U, K,

The process consists essentially of anodic treatment in a suitable electrolyte, with conditions so controlled that the rate of formation of the anodic oxide only just exceeds the simultaneous rate of solution of the oxide film.

As a result of detailed investigations carried out by the authors, it has been possible to increase the reflectivity of mechanically-polished aluminium (98-99 % purity) from 68.5 to 81.6 % by electro-polishing. A number of electrolytic baths utlising 'Alzac' and 'Brytal' processes besides various combinations of sulphuric acid, ortho-phosphoric acid, glycerine, n-butyl alcohol, trisodium phosphate, etc. have been tried and as a result of this study the composition and optimum working conditions of the bath which have been arrived at are as follows :

***Composition.***

| | | |
|---|---|---|
| O-phosphoric Acid (sp. gr. 1.75) | 1750 | c.c. |
| N-butyl Alcohol (B. P. 116-118) | 435 | c.c. |
| Distilled Water -- | 210 | c.c. |

***Working Conditions.***

| | | |
|---|---|---|
| Temperature of the bath -- | 40–55°C. | |
| Anodic Current Density -- | 43–44 | amps/sq. ft, |
| Voltage -- -- | 14–38 | volts. |
| Time of Treatment -- | 15 | mins. |

### 253. "Studies in Reduction and Intensification of Film Negatives."

D. R. DHINGRA, M. G. GUPTA and GIRISH C. JOSHI, Kanpur,

In photography, 'Reduction' means the removal of excess silver from a dense image so as to produce a less intense image, while the object of 'Intensification' is to increase the contrast. Thus in the case of an over-exposed or over-developed negative there may be too much of density of contrast, which can be reduced by suitable reduction; similarly an under-exposed negative can be amply intensified by suitable chemical treatment

In the present paper the authors have made a detailed and comparative study of the various reducing and intensifying baths suitable for film negatives mentioned in the literature After detailed investigations of a number of reducing solutions falling under the groups (a) Proportional, (b) Super-proportional and (c) Subtractive reducers, it has been concluded that a subtractive reducer employing 7.5 g./L of potassium ferricyanide solution for reduction and 200 g./L of sodium thiosulphate solution for fixation is most effective. It could reduce the printing exposure time of quite dense negatives from 5 secs. to 0.5 sec. utilising the same grade of paper. Moreover, it employs only commonly available chemicals.

A similar study of the intensifiers belonging to the classes of (a) Mercury, (b) Uranium and (c) Chromium, revealed that the chromium intensifier of the following composition is capable of producing as good results as those obtained with the costlier uranium intensifier.

| | | |
|---|---|---|
| Potassium Dichromate | 9.0 | g |
| Conc. Hydrochloric Acid | 6.0 | c.c |
| Distilled Water to make | 1000 | c.c. |

Both the uranium and chromium intensifiers increased the printing exposure time of 0.5 sec on velox paper no IV to 0.8 sec. on the softer velox paper no. III.

It may be added that the film negatives must be hardened in a 1 % formalin solution before being either reduced or intensified to prevent the gelatin layer from being affected

### 254. Oil of Champaca.

D. R. DHINGRA, G. N GUPTA, and U. N. SHUKLA, Kanpur,

The oil of champaca has not so far been prepared in India only its attar is made by the Indian perfumers.

The oil is very highly fragrant and pleasant smelling and its flowers are very much favoured by South Indians. It was, therefore, proposed to carry out some experiments to prepare the oil and study its properties.

In this paper a detailed description of the places of cultivation, methods of extraction of the oil from flowers and its properties is given. Two method (1) Hydro-distillation and (2) Solvent extraction were followed. As the experiments were carried out at Perlakimidi, the product obtained by solvent extraction method was very small and could not be examined. The oil obtained by hydro-distillation method was analysed to determine its composition. The oil was fractionated. It was found to contain cineol, isoeugenol, Methyl anthranilate and Phenyl ethyl alcohol etc. The % of different constituents could not be determined, as the quantity of oil was small. The oil can be one of items for export.

### 255. "Contact Insecticidal Activity of Some Alkoxy Analogue of D.D.T."

D. R. DHINGRA, S. N. KAPOOR, and P. N. KACKER, Kanpur.

Stephenson and Waters (J. C. S., 1946., 839,) have suggested from their work on the analogues of DDT that while the positions of the substituents in the aromatic nuclei are important it is the whole shape of the molecule which is significant.

The four species of grain pests viz. Triboleum castaneum Herbst Oryzaephilus surinamensis L, Calandra granaria L, and Ptinus Boield, were taken as test subjects for toxicity experiments (for which the authors are much thankful to the Entomologist Govt. U. P., for his very kindly supplying us insects and other help.) The insets were tried to see the toxicity of Methoxy Dt, Ethoxy DT. Hydroxy DT. and Butoxy DT. (they were prepared, by the authors in the Lab.) where as DDT was included as a standard with which to compare the toxicity of the substances. The toxicity to all the four species of insects of poisons in the series appears to be at a maximum in the Ethoxy and Methoxy compounds, the toxicity decreases with increasing molecular weight. The biological activity of DDT analogues as contact insecticides results from a reversible physico chemical reaction rather than any irreversible chemical action, and that the intensity of biological activity is dependent on the physicochemical properties of the molecule, although the compounds may be dependent for their toxicity on a specific molecular configuration.

### 256. "Production of Ethylchloride."

D. R. DHINGRA, S N. KAPOOR and J. P, MITTAL, Kanpur

Ethylchloride is used in the plastics industry as a ethylating agent, in the synthesis of dyestuffs and drugs, as a solvent, laboratory agent, in refrigeration and in medical application.

The general method of its preparation are either by the direct chlorination of hydrocarbon, or by replacement of alcoholic hydroxyl group by halogens.

A number of experiments were made to find out the optimum conditions for the production of ethyl chloride using different proportion of hydrochloric acid gas with various strengths of alcohl under different conditions. The behaviour of a number of catalysts was then studied including chlorides of mercury, calcium, iron, antimony, bishmuth and zinc. It was observed that anhydrous zinc chloride is decidedly the superior catalyst for the preparation of ethyl chloride.

Its preparation can easily be taken up, as all the raw materials are available in the country. The details of the apparatus used and the methods followed have been given in detail

### 257. Kinetics of thermal polymerization of Dehydrated Castor Oil.

K. K. DOLE and V. R. KESKAR, Poona.

The kinetics of thermal polymerization of dehydrated castor oil, obtained by using different types of dehydrating catalysts, is studied in this paper. The following catalysts were employed for the dehydration of castor oil. (i) Sulphuric acid, (ii) Benzene sulphonic acid. (iii) Anthraquinone 2-sulphonic acid (iv) Naphthlene 2:7-disulphonic acid. (v) Sodium bisulphate. (vi) Potassium phenol sulphonate. (vii) Potassium gauiacol sulphonate. (viii) The instantaneous catalyst.

From the increase in molecular weights and the viscosity it is found that the disulphonic acid give the dehydrated oil which polymerizes more rapidly than that obtained from the monosulphonic acids. The rate of polymerization of the oil obtained by instantaneous catalyst is found to be the most rapid of all.

### 258. Palma Rosa Plantation in Uttar Pradesh.

B. N. GUPTA, G. N. GUPTA and GANESH CHANDRA, Kanpur

The present investigation shows that pure geraniol can be prepared from palmarosa oil by the calcium chloride method. The import of geraniol should be restricted to minimum to encourage its production in the country as all the raw materials are abundantly available.

### 259. Some Sorptive Properties of Kashmir Bentonite.

B. P. GYANI, Patna.

The adsorption and desorption of water on Kashmir Bentonite at 0°, 20° and 35° has been studied. The isotherms corresponding to the two processes differ throughout the entire pressure ranges and are of Type II. Toluene gives a Type I isotherm and the volume of liquid sorbed at saturation is less than half of that half of that for water. It is suggested that the molecules may be oriented in the sorbed state, more so in the case of desorption than that of adsorption, and this may explain hysteresis. It is at the same time necessary to assume that some vapour molecules may be entrapped in the lattices of the adsorbem. These assumptions enable one to understand the heat curves for adsorption and desorption.

### 260. Antioxidants for Vegetable Oils.

S. M. HUSAINI and S. A. SALETORE, Hyderabad-Dn.

In view of the known fact that antioxidants found satisfactory for animal fats are not necessarily as good for vegetable oils, a comparative study has been made of how known antioxidants respond in the case of groundnut oil using the Swift stability apparatus. This has shown that we have still to discover an antioxidant for vegetable oils as good as BHA and NDGA for lard.

A systematic search for new antioxidants having phenolic and enolic hydroxy radicals has therefore been carried out and the results given for a number of synthetic products specially prepared for the purpose.

Theoretical inferences on structure and antioxidant properties lead one to look for new antioxidants indigenous to India.

### 261. "Venthenna"—Oil obtained by boiling off the expressed milk from ripe, undried cocoanut kernel.

B. H. IYER and N. L. NARAYANMURTHY, Bangalore.

By boiling off the milk expressed from 600 g. of scraped kernel of ripe, undried cocoanuts, 100 g. of a very sweet smelling oil has been obtained. The extraction of the expressed milk by carbon tetrachloride also yielded an oil (60 g. from 600 g. of kernel) having slightly different properties. Both the oils have been analysed. While the boiled oil yields unsaponifiable matter 4.86 per cent. and has no optical rotation, the extracted oil yields only 0.36 per cent. of unsaponifiable matter and has optical rotation + 2.074 (chloroform solution). The component acids of the boiled oil are: Caprylic acid (7.2 %), Capric acid (7.32 %), Lauric acid (40.65 %), Myristic acid (18.91 %), Palmitic acid (11.59 %), Stearic acid (3.59 %), Oleic acid (8.97 %), and Linoleic acid (1.90 %).

### 262. Limits of Applicability of Baudouin Test.

B. H. IYER and N. L. NARAYANMURTHY, Bangalore.

With a view to evaluating the limit of applicability of Baudouin test as a method for detection of adultration of ghee with vanaspathi, the following experiments have been conducted.

Ground nut oil has been adulterated with sesame oil in known proportions (0.2 to 2 per cent.) and the intensity of the red colour due to Baudouin test on the synthetic sample has been measured in a Klett-summerson's Photo Electric Colorimeter. The readings indicate that while the test is applicable even in 0.2 per cent. adulteration, the colour intensity is directly proportional to the amount of adulteration. Similar results have been obtained with synthetic mixtures containing known amount of sesame oil (0.2 to 2 per cent.) in sesame oil free hydrogenated ground nut oil kindly supplied at the instance of the Government of India by the Mysore Vegetable Oil Products Co. From these observations it has been deduced that adulteration of ghee to a minimum of 5 per cent. with vanaspathy could be detected, by applying Baudouin test.

The effect of temperature variations will form the future study in this direction.

### 263. Electrolytic Oxidation of Soaps.

S. S. KALBAG and J. G. KANE, Bombay.

Either hydrocarbons (Kolbe's reaction) or mixtures of alcohols and olefines (Hofer—Moest reaction) are produced when soap solutions are electrolytically oxidized. In the present investigation of the latter reaction, the effect of a variety of factors such as current density, solvents, soaps and salts and their concentrations, alkalinity, etc., on the yields of the products and the efficiency of the electrolytic cell reaction has been studied. Low current densities (0 5—2·0 amp. per sq. decimeter), salts like pot. chlorate, pot bicarbonate and pot. fluoride to the extent of 2—5 % and a pH of 9 have been found to give high yields of alcohols and olefines. Ethyl alcohol and acetone gave better yields than many other solvents and acetone was superior to ethyl alcohol in the concentration range of 20—50%. From amongst several soaps, soaps of coconut oil and oleic acid gave good yields and showed better current efficiency. Molecular magnitude and degree of unsaturation of the soaps also influence the reaction.

### 264. Sugar cane-wax Part I. Its purification and properties.

Y. P. KAPIL and S MUKHERJEE, Kanpur.

India imports annually about 26,000 cwt. of hard wax like carnauba wax for making shoe-polishes, carbon papers, printing inks, lubricants etc. During last war, when imports ceased industries depended on these suffered a lot and prices of carnauba wax went as high as Rs. 25 per lb Even the present price ranges from Rs. 8 to Rs. 6 per lb Cane wax, which can be obtained from press mud from the sulphitation sugar factories, after proper purification and refining can successfully replace the hard waxes which we are now importing.

Crude canewax, as obtained by solvent extraction has very dark colour, soft and is not suitable for direct use. To make it suitable for the manufacture of high grade leather polishes and printing inks etc. and to use it as substitute of carnauba wax, it should be defatted, deashed and bleached

Crude wax containing about 3% ash was de-ashed by Hydrocloric acid and defatted by melting it and pouring it under vigorous stirring in 3-4 parts of ethanol (96%) and maintained at a temperature of 25°C. The above process was repeated with fresh solvent. Recovery of hard wax was about 70%. Acetone was also used for defatting in place of alcohol but the solvent loss was found to be much more and the product obtained was very similar to that obtained by alcoholic precipitation.

When petrol-ether (Boiling point 80—100°C.) was used, a wax of very high melting point (82°) was obtained but in this case the yield is only 25 % of hard wax.

Refined wax was bleached with $KClO_3$ (10 %) and sulfuric acid (10 %) wax obtained was of light yellow colour. The colour of the different product obtained was measured in Lovibond tintometer. Saphonification values and iodine values were also determined to study the progress of purification.

### 265. High-Octane-Aviation Fuel.—Production of Mesitylene. Part I.

K. P. KOLEY and M. N GOSWAMI, Calcutta.

Acetone can be obtained from ethyl alcohol by one step process (Koley and Goswami—Proc. 39th Ind. Sc. Congress. Abstracts. P. ), Acetone can be converted to mesitylene using various catalysts, the conversion being very important as mesitylene has a high anti-knock value (Lovel. N. G. Ind. Eng. Chem. 1948, 40, 2388) and hence can be used in admixture with petrol as an aviation fuel. The reaction representing the conversion is as follows:—$3CH_3COCH_3 = C_6H_3(CH_3)_3 + 3H_2O$. The catalysts used by the authors in vapour phase conversion are activated alumina, alumina produced from Al-foil with water in presence of $HgCl_2$, Alumina-Chromia mixture supported on Kiesselghur, Alumina coated with phosphomolyedic acid and Alumina coated with phosphotungstic acid. In all cases the gases coming out of reaction chamber are carefully condensed and unconverted acetone estimated. The mesitylene formed is separated by fractionation, and indentified through its nitroderivative. With 30 gms of catalyst (activated alumina) at 500°C., using 100 gms of Acetone was obtained 2.6 gms of Mesitylene, amount of acetone unconverted being 33.23 gms. and time of reaction being 2.5 hours. The reaction is not so simple as represented by the equation but is complicated by other side reactions. Mesityl oxide is also found in the final product. Again a portion of mesitylene form probably undergoes decomposition to lower hydrocarbons. With alumina prepared from Al-foil and water, at 550°C reaction gives a better yield in comparison with previous charge, the other conditions being the same. The rise of temperature has a favourable effect upon the conversion but the life of catalyst is sriously affected with rise in temperature. Use of Kiessel guhr (10 % of the catalyst mass) as supporter of the alumina catalyst has no benificial effect upon the yield although it reduces the actual amount of alumina required for equivalent conversion Chromia-alumina catalyst is prepared by dipping

required for equivalent conversion Chromia-alumina catalyst is prepared by dipping

alumina in a solution of Chromic acid (In calculated amount so that % of $CrO_3$ in final mixture is 20 %) and then evaporating the solution, drying it and finally heating to 500°C it with 10–20 % of steam. The yield of mesitylene is not much increased although the total % of aromatic hydrocarbons in the water-in-soluble layer was higher. This may be due to the fact that mestylene first formed has broken down to lower hydrocarbons. Life of catalyst in this case is much higher. Use of phosphomolybdic acid or phosphotungstic acid definitely improves the catalysing property of active alumina. Alumina coated with phosphotungstic acid is prepared in the following manner Activated alumina (78 gms) is added to 8 gms of phosphotungstic acid in 46 gms of water. The impregnated mass is dried at 100°C for 18 hours and then calcined at 400°C for one hour. Similarly alumina coated with phosphomolybdic acid is prepared by placing alumina 95 gms in solution of 10 gms of phosphomolybdic acid in 60 gms of water and the mass was dried at 100°C for 12 hours and finally at 650°C for 3 hours. With this catalyst undesirable side effects are minimised. The lives of the catalysts were also prolonged. Temperature to be used is above 500°C because at 400°C the speed of reaction was very slow.. Alumina coated with phosphotungstic acid gives yield of 6.4 gms of mesitylene from 50 gms of acetone and time of circulation being 3 hours and 14.7 gms of acetone being recovered, at 550°C. With the other catalyst under similar conditions was obtained 7.4 gms of mesytilene.

### 286. Active Carbon from Alcohol Pyrolysis.

K. P. KOLEY and M. N. GOSWAMI, Calcutta.

When alcohol vapours are passed over iron oxide-calcium oxide mixture at temperatures 450 to 550°C, along with steam, acetone is formed. (Koley and

Goswami, Proc. 39th session Ind. Sci. Cong.). It has been observed that the catalyst becomes deactivated with use and becomes covered with carbon deposits. Higher the temperature, more is the amount of the carbon deposits. Higher the temperature, more is the amount of the carbon formed. Carbons thus formed from alcohol pyrolysis are examined for their properties as active carbon. Four different samples are compared with market Norite carbon. Carbon deposited on catalyst mixture which has been produced from chlorides with NaOH (A), carbon deposited on catalyst mixture which has been produced from chlorides Chloride with KOH (B), carbon deposited on catalyst produced from steam decomposition of calcium-ammonium ferrocyanide (C), carbon freed from supporter by $H_2SO_4$ digestion (D) and Norite (E) are used. From 46 gms. of alcohol and 36 gms. of steam at 550°C was obtained 18.23 gms. of carbon on 25 gms. of catalyst when time of passage was 3 hours. To test for activity, methylene blue adsorption and acetic acid adsorption methods are employed. Values of Freundlich's constant (K) are compared. Following values of 'K's are obtained for A, B, C, D, E respectively with methylene adsorption methods, 718.9, 159.1, 141.7, 188.6, 172.6., and values of 1253, 1326, 1129, 1512, 1543 with acetic acid adsorption method. From the values of 'K' obtained a comparative study can be easily made.

### 267. Investigations in Viscosities of Milks.

P. S. KULKARNI and K. K. DOLE, Poona.

Quantitative relationships between the viscosity and the contents of fat and solids-not-fat, in milk are studied. Equations are given for buffalo, cow, and goat milks.

On skimming, the viscosity decreases in proportion to the fat removed. A rise in temperature, causes a decrease in the viscosity of the whole as well as the skim milk. The percentage decrease in the viscosity at 25°C, stands in a descending order for the buffalo, cow and goat milk. The percentage decrease in the whole milk is larger, than in skim milk.

The viscosity of milk is also shown to bear a relation to the size of the fat globules in it, though not to the number of them. This is obvious from the mean values of the viscosities and the corresponding mean size i.e. the diameters of the fat gloubles, given as follows :

| | n (30°C) (centipoise) | — | mean diameter (microns) |
|---|---|---|---|
| Buffalo milk | 1.7782 | | 4.5457 |
| Cow milk | 1.5036 | | 4.1529 |
| Goat milk | 1.0475 | | 2.9728 |
| Ass milk | 0.9781 | | 2.7563 |

### 268. Mechanism of the Fischer-Tropsch Synthesis.

A. LAHIRI and N. G. BASAK.

The various mechanisms of reaction in the Fischer-Tropsch Synthesis of hydrocarbons have been critically reviewed in the light of new and old data. The present study reveals a definite change in the trend of thought and theory from the early acceptance of the important role played by the intermediate carbide formation which had been considered the only suitable mechanism until recently. The swing seems to be now more towards intermediate oxygenated compound theory.

### 269. Studies on the Plastic Properties of Indian Clays Plasticity and Particle Size.

D. LAHIRI and S. K. MAJUMDAR, Calcutta.

Four Indian Clays and one English ball clay were chosen for the present investigation. Plasticity, according to Bingham, is a complex function of two factors, viz., yield value and mobility. Following Bingham's method, yield value and mobility were determined by measuring the rate of flow through a capillary tube at different pressures. For each clay, mobility and yield value at different concentrations of water were determined and curves showing the relation of mobility of clay were compared. When two or more clays have the same mobility, the one with higher yield value is more plastic than the others.

Particle size measurement has been made with Andreasen Pipette. Size distibution curves show that plasticity is dependent on the fineness of the clay particles. Finer the clay-particles, greater is the plasticity. Ball clay was found to be much finer than all other clays studied and its plasticity was also found to be higher. The plasticity of ball clay was not found to be as high as could be expected from the fineness of its particles. Additions of small proportions of ball clay however were found to increase considerably the plasticity of a coarse clay like Kasimbazar clay having low plasticity. In the following table clays have been arranged in two vertical columns; in one column, clays are arranged in the order of decreasing plasticity and in the other in the order of increasing particle size.

### 270. Reaction Between Calcium Phosphate and Sodium Bisulphate.

Miss AKHTAR MOHAJIR and D. S. DATAR, Hyderabad-Deccan.

Reactions of Calcium phosphate with sodium bisulphate both at high temperature and in solution are studied. Sodium dihydrogen phosphate and disodium hydrogen phosphate are produced. The reaction was done with rock phosphate and bone. The yield is good. The mechanism of the reactions is discussed.

### 271. Production of Mixed Fertilizers.

Miss AKHTAR MOHAJIR and D. S. DATAR, Hyderabad—Deccan.

The production of mixed fertilizers containing desired proportions of phosphorous, nitrogen and potassium by reacting rock phosphate or bone with requisite amount of potassium and ammonium in sulphates is described.

### 272. "Edible Gelatine from Bone".

K. N. MOORTHY, Hyderabad Deccan.

A process for the preparation of edible gelatine using bones fresh from the slaughter house is described. Di-calcium phosphate fertilizer is obtained as a bye-product.

### 273. "Sulphur from Iron Pyrites".

K. N. MOORTHY and D. S. DATAR, Hyderabad Deccan.

World is experiencing acute sulphur shortage, as the sources of natural sulphur are rapidly being depleted, due to enormous consumption for the growth of agricultural products. To ease this situation other sources of sulphur production are being tapped and considerable research work is being done all over the world in this field. This paper deals with the production of sulphur from iron pyrites. By passing steam over heated iron pyrites hydrogen sulphide is liberated. It is combined with sulphur dioxide in the medium of water when sulphur is obtained. The yield of sulphur is 98 per cent The costings and flow sheet of the process are given

### 274. "Utilization of bone glue".

K. N. MOORTHY and D. S. DATAR, Hyderabad—Deccan.

The glue that was prepared from bone by the process evolved in the laboratories compared well with a standard glue sample. Its application to the match and printing roller industry is considered. Tests are indicated to distinguish good glue from bad glue with reference to match industry. The ingredients for a successful sample of roller composition are given.

### 275. Cation Exchanges from Sugars.

S MUKHERJEE and H C. SRIVASTAVA, Kanpur.

Cation exchange resins from glucose and sucrose have been prepared by condensation of these sugars with phenol sulphonic acid. The resins are obtained in the form of black, shining flakes and granules of irregular shape. They are insoluble in water and organic solvents. The properties of sucrose phenolsulphonic acid resin have been studied. Ion exchange capacity of the resin is about 2 milli-equivalents/gm. of the resin and which compares favourably with some of the cation exchange resins which are used for industrial processes and for water softening. Further work on the preparation and properties of cation exchange resins from carbohydrate materials is in progress.

### 276. Economics of *Annona Squamosa* (Linn) Seed Production in Hyderabad.

N. BHOJRAJ NAIDU and S. A. SALETORE, Hyderabad.

### 277. Economics of *Ammona squamosa* (Linn.) Seed Production in Hyderabad.

N. BHOJRAJ and S. A. SALETORE, Hyderabad.

Last year's communication (Proc. 39th Ind. Sc. Cong. Part III, Abstracts, p. 130) described the potential availability and value of sitaphal seed fat in the state, based on acreages and estimated number of trees per acre. This present paper describes the actual collection of over 30 maunds of seeds (containing 5 % contaminants) from 238 maunds of refuse in Hyderabad city in 1951, (i.e., about 13 % or about one-seventh), by a method comprising sieving, floatation, winnowing and handpicking. The estimated costs indicated that the seed could be made available in a fairly good condition at a maximum of Rs. 8/- (Indian Currency) per maund of 40 seers, hardly one-third of say, groundnuts. A revised estimate based on 0.5 lakh ton of seed showed that Rs. 30 lakhs worth of seed, 50 lakh lb. of actual expressed fatty oil, and 200 lakh lb. of oil cake (4.3 % nitrogen). worth about Rs. 9 lakhs could be made available in the state, releasing thereby the more expensive groundnut oil for edible purposes from soap-making industry. The medium of radio, press and other agricultural and allied departments to propagate the value of this seed is stressed.

### 278. Studies in the Composition and Utilisation of Wood Tar. Part I—Composition of Wood Tar.

C. S. BHASKARAN NAIR.

The results of investigations conducted on the tar produced as a by-product in the producer plants of Messrs. The Fertilisers and Chemicals Limited, Alwaye, are described. About ten tons of tar are thrown out per day in the factory and this foms a major disposal problem for the firm.

On distillation, the tar gave water—30.8—34.6 %; Light oils (upto 120°C)—1.4—1.9 %; Heavy oils (20—285°C)—20.6—25.1 %; and Pitch —39.3—39.3—40.1 %, —acids, bases, phenols and neutral compounds by suitable extraction treatment. The oily portion of the distillate was separated into definite classes of compounds The tar distillate gave acid 1.75 %; bases 1.78 %; phenols —65.5 % and neutral compounds —30.18 %.

### 279. Decomposition of Limenite Under Reducing Conditions.

K. VISWANATHAN NAIR, Trivandrum.

The main commercial use of ilmenite is for the manufacture of titanium white pigment. In the usual process of this manufacture the mineral is treated with sulphuric acid in order to decompose it. A cheaper method of decomposition using sodium sulphate and carbon obtained from burnt paddy husk, has been worked out in detail. The reducing mixture used had a composition: one part of sodium chloride to three parts of carbon to twelve parts of sodium sulphate by weight. The variants in the reaction were:

1. The proportion of the mineral to the reducing mixture.
2. The temperature of reaction,
3. The time of reaction.

Hence keeping two of these variants constant and varying the third systematically, three sets of reactions were carried out and the optimum conditions were obtained by graphical arrangement of data. It has been found that these conditions for the complete decomposition of the mineral are,

1. The maximum ratio of the mineral to the reaction mixture must be 1 : 2. (one of mineral to two of mixture by weight).
2. The minimum temperature of the reaction is 825 deg.
3. The minimum time of reaction is 100 minutes.

### 280. Investigations on Hyderabad Clays for making Fireclay Refractories Part III.

M. D. NARASIMHAN and S. H. ZAHEER, Hyderabad Deccan,

Investigations on mixtures of Shekapur clay and Pachgaon clay show that, the addition of Pachgaon clay to Shekapur clay increases the strength of the bricks. It was found that, as the porosity of the mixtures decrease with the addition of Pachgaon clay, the apparent specific gravity decreases and the Bulk density increases. There was no shrinkage on reheat.

### 281. Isomerized Oils.

K. ANANTH NARAYAN and B. S. KULKARNI.

Isomerized oils are chemically processed naturally occuring semi-drying and drying oils which in many respects show better drying properties such as high capacity for polymerization, better resistance to water, alkali, acids and solvents than the conventional drying oils. Isomerization is catalytically brought about by obtaining a shift of the double bond to the conjugated position. The isomerization process has not so far attained complete commercial success although small quantities of isomerized oils have appeared on the market. The paper describes the various methods available for isomerization, the favourable and unfavourable properties of such oils in surface coatings and also takes a review of the various mechanisms in explnation of the isomerization process. The paper also refers to the peculiar analytical aspects which had to be developed in order to both understand the process and effect a control on the various products obtained. The subject in the paper is covered by 42 references.

### 282. Urea Complexes of Fatty Acids.

K. ANANTH NRAYAN and B. S. KULKARNI.

It was discovered by F. Bengen in 1940 that when urea was added to long chain organic compounds in presence of a solvent, solid urea complexes were formed. As the formation depended on the amount of saturation in the chain the method could be utilised for separation in fatty acid mixtures. Urea complexes were formed with mixtures of fatty acids obtained from cottonseed, linseed, niger-seed, castor and safflower oils in presence of methanol, ethyl alcohol and methylated spirit and the amout of separation were studied on the basis of iodine value estimations by Wij's & Tom's method and the refactive indices. Use of elevated temperature for complex formations yield sharper separations. Fractional separations of the acids could be obtained by cooling the system from a higher temperature to room temperature Pure glycerides did not form complexes but free fatty acidity in crude oils could be removed by adduct formations. Repeated extractions with safflower oil yielded linoleic acid of 95 % purity. Hence this method with a more refined technique may easily serve as a laboratory method for the preparation of pure linoleic and linolenic acids, which could be stored in the form of adducts to prevent oxidation and rancidity.

### 283. Thernal Decomposition of Magnesium Sulphate.

Miss RAZIA OSMANI and D. S. DATAR, Hyderabad -Deccan.

Magnesium sulphate is a raw material for the manufacture of sulphuric acid and the study of its thermal decomposition is of commercial importances. The decomposition of magnesium sulphate-hypta hydrate alone at 800°—900° is only 7 %. It is greatly accelerated by the addition of alumina, the decomposition in presence of equal weight of alumina being 95 %.

### 284. Technical Uses of Argemone Oil.

Om PRAKASH, ATMA RAM, BRAHMA PRAKASH, and S. N SAXENA, Kanpur

The work was undertaken from the U. P. Scientific and Research Committee with a view to divert the use of argemone seed and its oil into legitimate commercial channels and thus remedy the problem created by the adulteration of mustard seed with argemone seed.

The technical fields in which the use of argemone oil has been studied are :—Paints and varnishes, Soap, Lubricants, Illuminants, hair oils and phenyl. Physiological action of the oil and its use in medicine were beyond the scope of this work.

The oil as such or after dehydration can be used along with linseed oil in the preparation of boiled oils for use in paints and varnishes. The oil can be used in the preparation of soap (soft soap as well as hard soap) along with other oils. The oil can be thickened like rape oil by blowing air through it at 150°C and the blown oil can be used for preparing blended lubricants. The thickened oil can also be used is as substitute of linseed stand oil in the manufacture of printing inks. The oil after refining can be used along with other oils such as til, groundnut, and castor in the preparation of hair oils. The oils is not suitable for use in the preparation of phenyl.

### 285. Detection of groundnut oil in Mustard oil.

**Om PRAKASH, ATMA RAM, BRAHMA PRAKASH and M. K. SINGH, Kanpur.**

**The most common adulterants used for mustard oil are linseed and groundnut oils. The adulteration of linseed oil can be easily detected by a marked**

increase in Iodine value, whilst there is some difficulty in detecting the adulteration of groundnut oil as the analytical constants of the two oils are very near each other. Bellier's test as modified by Ever's has been made use of in detecting the adulteration of groundnut oil in mustard oil. Turbidity temperature of pure samples of mustard oils from different sources and those of groundnut oil have been determined. Turbidity temperatures of mixtures of groundnut and mustard oils in different proportions have been determined and conclusions have been drawn which are useful in detecting adulteration of mustard oil with groundnut oil.

### 286. A Study of the Various types of Oilcakes Produced in Uttar Pradesh.

Om PRAKASH, T. R. SHARMA and AMANULLAH KHAN,

India is an important country with regard to the production of oil seeds and oils. In India, U. P. is a major oilseed producing State and possesses a well developed Oil industry. Although oilcake is an important bye-product of the oil crushing industry, yet no work appears to have been done so far in the country and reliance, so far, is mainly placed on the results reported in the literature based upon the work carried out in foreign countries.

A large number of different oilcakes from different crushing centres of U. P. processed in various pressing units have been procured and analysed. Important data on composition of different oilcakes have been given and conclusions drawn on the results obtained.

### 287. Preparation of activated carbon from linseed Pod Huck.

Om PRAKASH, A. C. GUPTA, B. D. SETH and R. N. VERMA,

The present work was undertaken with a view to utilise a bye product of linseed plant viz. linseed pod husk, left after de-seeding, which is at present being wasted. The activated carbon was prepared with calcium oxide as the avetivator. The optimum conditions for the preparation of activated carbon from this raw material have been studied by varying the proportions of activator, time of carbonisation and temperature of carbonisation etc. The optimum conditions found out are ratio of activator to husk 1 : 4, temp., of carbonization 900°C, and time of carbonisation 1 hr. The carbon prepared compares favourably with some of the best brands available in the market for bleaching of oils.

### 288. Comparative Study of Indian Coal Tars.

S. M. PRASAD, Patna.

Properties of representative sample of tars from eight tar producing centres in India have been compared. Specific gravities, water percentages, ash contents, distillation dates (210°C, 210°- 230°C, 230° — 270°C, 270°- 300°C and 300°-340°C), pitch percentages and percentages of tar acids in Oils to 340°C have been determined. All the tars seem to be very poor in yield of tar oils except a gas works tar and two hard Coke Plant tars which yield (w/w) 41 %, and 35.5 % respectively of Oil on distillation to 340°C. The oils from these three tars are

**comparatively richer in tar acids— 22.4 %, 11.0 % and 13.2 % (w/w) respectively. All the other five tars are very poor in yeild of tar oils and the oils contain very little tar acids. Except the above three tars all others are rich in naphthalene.**

### 289. Production of Lower Monohydric Phenols from Higher Tar Acids.

S. M. PRASAD, Patna.

**The Oils from Low Temperature producer gas tars contain high proportion of tar acids. But most of these tar acids consist of high boiling fractions which are not very suitable for plastic industry. Attempts were made to convert them into low boiling phenols. In the mass of literature available many contradictions were noted regarding the best conditions for getting the desired products. Preliminary experiment in a slanting iron tube heated in gas fired furnace showed that 700°C was the most suitable temperature for cracking and the slanting position of tube contributed to excessive carbon deposition. An improved cracking apparatus was made consisting of a silica tube (1″ diam. & 37″ long packed with sealed thin silica tubues) heated in an electric furnace. The higher tar acids were dropped from top by means of an Oil dropper and the cracked product collected at bottom. Several runs were made at different temperatures and different feed rates. Helpful deductions were drawn from the results obtained. By cracking at lower temperature and for a longer period larger yields of low boiling Phenols expected. Another apparatus has been made in which the higher tar acids will be heated in an iron still and the vapour allowed to go up a column kept at the desired temperaure. Wih he help of a suitable reflux low boiling phenons will be taken while the high boiling ones will go back for more cracking. Cracking may be done under different gaseous atmosphere and in contact with different catalysts. The full drawings of the apparatus used have been given.**

### 290. Dehydration of Castor Oil by Disulphonic Acids.

A. S. RAJADHYAKSHA and K. K. DOLE, Poona,

**Dehydration of castor oil can be successfully carried out by using different disuphonic acids.**

**The effect of folowing disulphonic acids on dehydration of castor oil was studied both at atmospheric pressure and under reduced pressure. The temperature employed was 250°C. and the time of reaction was fifty minutes. The catalysts were: (1) Benzene meta disulphonic acid, (2) 2 naphthol 6 : 8 disulphonic acid. (3) Napthalene 1 : 5 disulphonic acid. (4) Napthalene 2 : 7 disulphonic acid (5) Anthraquinone 1 : 8 disulphonic acid (6) Anthraquinone 2 : 6 disulphonic acid (7) Anthraquinone 2 : 8 disulphonic acid.**

**Anthraquinone 1 : 8 disulphonic acid acid was found to be more active than Antharaquinone 2 : 8 disulphonic acid while Anthraquinone 2 : 6 disulphonic acid was the least active of all.**

**Napthalene 1 : 5 and Napthalene 2 : 7 disulphonic acids were found to be equally active.**

**All the above disulphonic acids with only an exception of 2 Napthol 6 : 8 disulphonic acid gave dark coloured samples with high acid number. Under reduced**

pressure the acid number was low but the colour was dark; and the catalysts were slightly less active.

In all the above cases the percentage was as low as 0.1 % for No. (1), (5), (6), (7), and 0.2% for the remaings.

### 291. Differential Thermal Analysis of Cartalyst Powder.

V. S. RAMCHANDRAN, S. SOURIRAJAN and S K. BHATTACHARYA, Kharagpur.

### 292. Studies in the structural changes of copper sulphate pentahydrate by Differential Thermal Analysis.

V. S. RAMACHANDRAN and S K. BHATTACHARYYA, Kharagpur.

The structural changes in copper sulphate pentahydrate have been studied both by differential couple method (Taylor and Klung, J. Chem. Phy. 1936, *4*, 601) and thermopondeiometric analysis (Luigi Galimbert, Chem. Zentr., 1941, *1*, 2919). The results obtained by the above workers widely differ and are conflicting.

The former workers obtained endothermal effects at temperatures of 29°, 35°, 53.7°C, 96.5°, 102° and 113°C respectively The first three low temperature changes are explained as due to oscillatory to rotational energy changes in the crystal and the last three to the stepwise dehydration was found to take place in a different manner, the transition occuring at 30-38°C resulting in the loss of two more molecules of water and the third at 200°C-220°C resulting in the formation of completely dehydrated copper sulphate.

The differential thermal analysis of copper sulphate crystals (A. R. quality) has been studied in order to throw more light on the nature of the structural changes. The following conclusions were arrived at.

(1) Low temperature transitions are due to the water nedeels changing from oscillatory to rotational type and the energy changes involved are very small They may not necessarily occur in three stages but by a few more stages as observed by us, by altering $\frac{\Delta e}{\Delta Tm}$ the sensitivity of the galvanometer.

(2) the dehydration of copper sulphate pentahydrate ($CuSO_4$, $5H_2O$) may take pace in four stages as follows :

(a) $CuSO_4$, $5H_2O$ (copper sulphate pentahydrate) → $CuSO_4$, $4H_2O$ (copper sulphate tetrahydrate) at 101°C.

(b) $CuSO_4$, $4H_2O$ (copper sulphate tetra hydrate) → $CuSO_4$, $3H_2O$ (copper sulphate trihydrate) at 108°C.

(c) $CuSO_4$, $3H_2O$ (copper sulphate trihydrate) → $CuSO_4$ $H_2O$ (copper sulphate monohydrate) at 134°C.

(d) $CuSO_4$, $H_2O$ (copper sulphate monohydrate) → $CuSO_4$ (dehydrated copper sulphate at 272°C.

### 293. Differential Thermal Analysis of $NiI_2$ : $SiO_2$ System.

V. S. RAMACHANDRAN, S. SOURIRAJAN and S. K. BHATTACHARYYA, Kharagpur.

Bhattacharyya and Sourirajan (J. Sci Industr. Res., 1952, *11B*, 123) have reported that the yield of acetic acid from carbon monoxide and methyl alcohol reaches a maximum value under an optimum pressure of 260 atms. and a temperature of 180°C by using 84.6 % $NiI_2$ on silica gel as the catalyst. Further, when the erperiment is repeated by using the spent catalyst, the yield of the acid progressively decreases each time by about 50 % over the previous value. But when a small amount of water is added to the spent catalyst, the catalyst regains its activity completely and the yield of acid comes to its original value.

In order to throw some light on the mechanism of this process, differential thermal analysis of the following systems were carefully investigated : (1) Silica (2) Nickel iodide (3) $NiI_2$ : $SiO_2$ (before use as a catalyst) (4) $NiI_2$ : $SiO_2$ (after use as a catalyst) (5) System 4 with a small amount of water.

The results reveal that the system 5 differed from the rest in exhibiting an unmistakable exothermic peak at a temperature of 95°C. This may be explained as being due to the decomposition of the active compound formed between the spent catalyst and water. Furthermore the active compound is stable at high temperatures only under high pressures but unstable at high temperatures at atmospheric pressure.

This was confirmed by releasing the products each time at a temperature below 95°C, when the catalyst did not lose its activity.

### 294. Magnetic Separation of Iron in Hyderabad Clays. Part I.

BALABHEEM RAO and S. H. ZAHEER. Hyderabad-Dn.

Iron was removed from clay by passing clay slips through a magnetic separator. The effect of removal of iron on colour on firing was noted.

### 295. Magnetic Separation of Iron in Hyderabad Clays, Part II.

BALABHEEM RAO and S. H. ZAHEER, Hyderabad-Dn.

The clays were washed and passed through magnetic separator to remove iron. Strinkage, Porosity, apparent and Bulk densities of these clays at different temperatures 1150°C—1400°C were studied.

### 296. Ethyl Alcohol : A potential solvent for the Solvent Extraction Industry in India.

RAMAKANTH RAO, Hyderabad (Dn).

The establishment of the Solvent Extraction industry is very essential, in order to recover oil worth crores of rupees. Usual solvents like Benzene, Trichloroethlene, Normal Hexane and other petroleum solvents are not easily available in India and have to be imported. Ethyl Alcohol is produced in great quantities in India. It was used for the extraction of Sayabeear oil in Japan. It is gaining ground in America also. Its use as a solvent in the solvent extraction industry in India to extract, Groundnut oil and cottonseed oil is suggested. Its advantages and disadvantages are discussed. Use of azeotropic mixtures of alcohol,

### 297. Decomposition of Sodium Chloride by Steam.

### 297. Decomposition of Sodium Chloride by Stem.

T. L. NARASIMHA RAO and D. S. DATAR, Hyderabad Deccan.

The decomposition of sodium chloride by steam at 800°C is negligible. It is slightly more in presence of alumina and appreciably increased with further addition of coke or silica.

### 298. "Recovery of titanium from bauxite as titanium sulphate."

T. L. NARASIMHA RAO and D. S. DATAR, Hyderabad Dn.

It is found that the conversion of titanium in bauxite to titanium sulphate is 86.9 %, when the bauxite is heated at about 350°C, with an excess of iron pyrites in the presence of air and the residue leached with an aqueous solution of sodium sulphate. But pure titanium dioxide does not yield titanium sulphate when heated with different proportions of iron pyrites and the residue leached as above. Optimum conditions for the recovery of titanium from bauxite are being determined.

### 299. The Preparation of Levulinic acid from Bagasse.

N. SHANMUKHA RAO and K RAMCHANDRAN, Hyderabad.

In continuation of the two previous communications by the authors (Proc. 38th Ind. Sc. Cong., Part III, Abstracts, p. 102 and Proc. 39th Ind. Sc. Cong., Part III Abstracts, p 103) where the method of preparing pure levulinic acid from cane molasses has been described, this paper deals with experiments carried out on bagasse as the raw material for the preparation of levulinic acid. Experimental details are given where bagasse was first treated to hydrolyse the pentosans and the residue was furthetr treated to hydrolyse the cellulosic portions to glucose. After separation of the unreacted lignin fractions, the cellulose hydrolysate was used to prepare levulinic acid. From 10.7 grams of reducing sugar obtained from the hydrolysis of the cellulosic portions, three grams of pure levulinic acid were isolated by methods described in the earlier communications

### 300. Degradation of Bituminous Coal by Hydrogenolysis.

A. N. ROY, Kharagpur.

For the elucidation of the chemical structure of bituminous coal which is generally recognised as a 'natural net work polymer, investigations have been carried out on the degradation of this complex net work with the least possible change in the essential chemical nature of the resulting fragments. In a previous paper (Roy and Howard, J. Phy. & colloid chem. *53*, 1033, 1949) the results of the studies on the molecular size and shape of the primary degradation products of a bituminous coal have been reported. The present paper deals with the investigation that led to a method for obtaining such products.

Liquid phase degradation of a Pittsburgh seam coal over the temperature range of 300–400°C, using widely varying types of solvents possessing aromatic and hydro-aromatic structures and of high internal pressure, gave materials which proved unsuitable for prepaing the size of degradation products in which we were interested.

Mild hydrogenation in the presence of Copper-chromium oxide catalyst over the temperature range 300–400°C using 1800–1900 p.s.i.g. cold hydrogen pressure and a 24 hour reaction period proved a very useful process. The special feature of the reaction vessel is a cold-head receiver which permits escape of the hydrogenation products from the reaction zone as soon as they are sufficiently volatile to distill, thus minimizing the occurrence of secondary reactions. The minimum temperatures found for obtaining the desired product was 325°C. That ahe reaction was mild could be determined from the kinetic study of the hydrogenation process. From the change of pressure with time the following values for reaction velocity and energy of activation were obtained: $K_{325} = 4.6 \times 10^{-6}$ sec.$^{-1}$; $K_{37}$ $= 1.4 \times 10^{-5}$ sec$^{-1}$ and $E = 17{,}500$ calories. From measurement on the volatile hydrogenation products, at different temperatures the value of the apparent heat of reaction was evaluated as 11,860 celories.

### 301. Bleaching of Carotene in Oils.

B. R ROY, Calcutta

The state of vitamin A nutrition of the people of India is generally unsatisfactory. It has sometimes been suggested that certain brands of edible oils suitably enriched with carotene might lead to an improvement of the situation. This proposal requires, however, an investigation of certain related problems. Some work was undertaken to explore the possibilities of enriching edible oils with carotene under varied conditions.

### 302. Vapour Phase Vinylation. Part I. Synthesis of vinyl methyl ether from methanol and acetylene.

D K, ROY CHAUDHURI, S N SEN and S. K. BHATTACHARYYA, Kharagpur.

Following the important discovery of Reppe that acetylene under pressure and in the liquid phase is able to react with alcohol in presence of a alkali catalysts to from vinyl ethers, the process has been considered to have immense possibilities But the details of these processe are lacking, particularly of the vinylation in the vapour phase.

The reaction between methanol and acetylene in the vapour phase at atmospheric pressure and at 160°—220°C, in presence of alkali catalysts has been throughly investigated.

Amongst the catalysts tested, active charcoal impregnated with NaOH showed the highest activity Soda lime as a catalyst showed poor life and gave lower yields of vinyl ether.

The influence of various factors, i.e. temperature, space velocity, acetylene: alcohol ratio, etc., has been studied. The percentage conversion of methanol to

**vinyl ether increased with increasing temperature to a maximum at 190°C; further increase in the ratio was attended with a fall in the yield. Increase in acetylene: alcohol ratio increased the yield to a maximum value; further increase in the ratio decreased the yield.**

**Using a catalyst containing 50 % by weight of NaOH on active charcoal, a conversion of 31.2 percent of methanol to methyl-vinyl ether was obtained at 190°C with an acetylene: methyl alcohol ratio of 2.8 and a space velocity of of 75.13 litres of acetylene per hour per litre of catalyst volume.**

### 303. Studies on the Desulphurisation of High-Sulphur Indian Coals—Part II.

M. M. ROY and M. N. GOSWAMI, Calcutta.

In a previous publication (Proc 39th session Ind.. Sci. Cong.) the authors investigated the action of silica and sodium silicate on high-sulphur Assam coal durng carbonisation. It was found that about 67 to 68 % of the sulphur was removed by the process. In the present work the authors have investigated the action of high-temperature tar on the desulphurisation of Assam coal For this purpose, tar containing less than 0.5 % sulphur was treated with the coal sample and carbonised. Varying amounts of tar from 5 to 20 % were mixed with the coal sample and on carboniation it was found that with increase in the percentage of tar as also with variation in time of carbonisation there was no appreciable change in the result and only when 20 % tar was used the sulphur in coke came down to 1.88 %, from an original sulphur content in coal of 4.57 %, when the mixture was carbonised for 6 hours at 850°C Otherwise, the percentage of sulphur in coke varied from 2.4 to 2.68 % The next operations were carried out in presence of steam. With ordinary steam, the maximum desulphurisation was attained at when about 158 litres of steam was passed during carbonisation of the coal at 850°C for 6 hours, when the sulphur in coke came down to 1.98 %. With superheated steam (steam superheated to 500°C), there was further desulphurisation and the best result in this case was obtained when about 155 litres of steam was passed for 6 hours at a carbonising temperature of 850°C, when the sulphur in coke came down to 1.81 % The defect in using steam is that there is considerable loss of coal during carbonisation dueu to the formation of water gas etc. It has also been observed that with increase in the percentage of tar, the caking tendency of the coke is lost as is the case with steam. A quantitative measurement of the distribution of sulphur in the products of carbonisation show the preponderance of $H_2S$ over others This $H_2S$ is also a good source of sulphur and which can be recovered by any of the commercially feasible methods.

### 304. Studies on the Desulphurisation of High-Sulphur Indian Coals—Part III.

M. M. ROY and M. N. GOSWAMI, Calcutta.

In part II of this series we have seen the action of steam and tar and have found that the cokes obtained therefrom are not so caking in nature and the results of desulphurisation not so satisfactory. In this part, this effects of using silica and sodium ilicate in presence of steam have been investigated. It has been

$H_7C_3N$ NH

**successively. At the initial stage, foreign cations in solutions are adsorbed at the found that silica is more effective than sodium silicate in this respect. For example with 5 % silica a maximum desulphurisation of about 83 % is attained, when**

carbonised for 6 hours and using 53 litre of steam the percentage of sulphur being brought down to 1.20 from 4.57 (original). Variation in time of carbonisation has an effect and at lesser carbonisation time more of the sulphur is retained in the coke. The cokes are also caking ones which may possibly be due to the presence of silica. Increase or decrease in the percentage of silica does not show a better rate of desulphurisation and the sulphur in the resulting coke practically lies between the limit 1.52 and 1 86 % (the original sulphur in coal being 4 58 %). The cokes in all the cases are more or less caking ones. With Sodium silicate, on the other hand, there is much less effect than was expected. With 2 % Sod. Silicate and with about 286 litres of steam, the sulphur in coke is reduced to 1.41 % at 850°C, the carbonisation time being 6 hours, whereas with 4 % Sod silicate and with about 17 litres of steam the sulphur in coke comes down to 1.85 % under identical conditions The coke in the former case is non caking probably due to excess steam whereas in the latter case it is caking. The sulphur distribution in the products of carbonisation show that maximum amount of coal sulphur is evolved as $H_2S$ in the products, the rest being measured in tar and liquor, also as mercaptan as thiophene, as Carbon disulphide and carbon oxysulphide

### 305. Lubricating Power of Oils on Jute.

A. N SAHA,

A simple instrument has been designed to measure the friction between fibre to fibre. The lubricating power of a mineral oil has been found out Co efficient of friction between fire to fibre (11 % regain) is 0 536 and between fibrer having 2 % oil on these is 0.489

### 306. Oxidation of Cane Sugar to Tartaric Acid.

A N SAHA

Cane Sugar has been oxidised with Nitric acids of different strength at different temperatures with $V_2O_5$ as Catalyst. A yield of 22 % Tartaric acid on the weight of the Cane sugar has been obtained.

### 307. The Basic Constituents of "Gas-tar".

S. K. SAHA, Calcutta.

The basic fraction of light oil derived from the distillation of tar supplied by the Gas Company was subjected to fractional distillation by means of an ingeniously devised double Gan's Column. By repeated fractionations, it was ultimately separated into its constituents : pyridine, -picoline, " -picoline," and 2 : 4-lutidine Unlike other -picoline fractions from other sources, the "' -picoline" fraction from gas tar was found to contain practically no -picoline nor any 2 : 6-lutidine. When oxidised by potassium permanganate, it gave, however, nicotinic acid in good yield. The 2 : 4-lutidine fraction is similarly oxidised by potassium permanganate giving 2 : 4-lutidinic acid. The latter when heated above its melting

### 308. Phenolic Resins Part I.

S. N. SAHAI and M. S BHATNAGAR, Kanpur.

The phenol-formaldehyde reaction has been studied at a low temperature which yields a light coloured resin On extraction with ether about 2/3 of the theoretical yield was obtained. This on crystallisation under different conditions gave several crystalline products, resembling the two mono-and the two di-alcohols. Further attempts to separate hte various alcohols into ortho-and para-isomers have not yet proved successful. Although the work is of a preliminary nature but it has been proved beyond doubt that these light coloured resins can be obtained by the polymerisation of these mono and di-alcohols Any attempt to use higher temperatures, yields in very dark coloured products

### 309. Vapour Phase Chlorination of Ethyl Alcohol under Silent Electric Discharge Part—I. Preliminary Studies.

R. H. SAHASRABUDHE, O. P. MALHOTRA and B. N. TRIVEDI, Banaras,

A number of chlorine derivatives of ethyl alcohol e.g. ethyl-chloride, chloral, chlor-acetic acids, tetra-chloro and hexa-chloroethanes, chloroform, and carbon tetrachloride are of great economic interest as solvents, therapeutics and resin bases. Since the alcohol is the primary raw material for the organic chemical industry in our country and there is a large possible prospective surplus of chlorine and electricity likely to be available in the near future, a study of chlorination of alcohol was deemed desirable. This besides was also of theoretical interest.

Streaming chlorine at 6 c.c./sec. mixed with alcohol vapour obtained from rectified spirit maintained at 50 to 60°C. was passed through a vertically clamped Siemens' type all-glass ozonizer (about 18 inches long and with inter-electrode-distance 2 to 3 mm. excited by 50 A. C at 9 kV. The duration of discharge tube was provided at the exit end with a trap cooled in freezing mixture. The products collected were separated by fractionation which gave (i) a fraction b.pt. 85-100°C, (ii) another b.pt. 100-150°C. and (iii) the third with b.pt, 160-190°C, The (i) proved to be mainly a mixture of unreacted alcohol and chloral, which on the basis of alcohol taken corresponded approximately to 25 % and 20 % respectively. The (ii) proved largely to be chloral alcoholate and represented 5 %; while the (iii) which was the major fraction was identified with dichloro-acetaldehyde-acetal corresponding to 40 % of the alcohol taken. Further work is in progress with respect to the number of variables that are expected to influence the reaction.

### 310. Dehydration of Castor oil with "Esters of Sulphonic acids" as Catalysis.

V. A SARAF and K K. DOLE, Poona

The dehydration of castor oil was carried out by using esters of sulphonic acids as catalysts. Following three esters were studied: (1) methyl benzene sulphonate (2) ethyl benzene sulphonate and (3) ethyl toluene p-sulphonate. Their activity was studied both under atmospheric conditions as well as under reduced pressure. The effect of variation of the percentage of the catalyst in the dehydration was observed at two different temperatures — 250°C and 280°C.

The methyl and ethyl esters of benzene sulphonic acid gave complete dehydration under the following conditions: 0.2 % Catalyst; 280°C + 5°C temperature and time : 50 minutes. ethyl toluene p-sulphonate gave nearly complete dehydration when 0 4 per cent of it was employed at 280°C for 40 minutes.

### 311. Adsorption of Carbon Monoxide and Hydrogen on Cobalt Fischer-tropsch Catalysts.

M. V. C. SASTRI and T S. VISWANATHAN, Kharagpur.

The mechanism of the Fischer-Tropsch synthesis has been the subject of considerable controversy. A study of the interaction of carbon monoxide and hydrogen on the catalyst surface was undertaken, at temperatures below which detectable reaction occurs, with a view to finding out the nature of the active substrate

The catalyst used had the composition Co: $ThO_2$ : Kieselguhr as 100 : 18 : 200 parts by weight. The interaction between the two chamisorbed molecular species was studied by two methods; (a) the presorption method where the effort of prior adsorption of small amounts of carbon monoxide on the adsorption of hydrogen was studied, and conversely the effect of presorption of small amounts of hydrogen on the adsorption of carbon monoxide · and (b) the mixture adsorption method where the simultaneous adsorption of carbon monoxide and hydrogen on the catalyst was studied at various temperatures, with the help of a built-in-thermal conductivity meter for the analysis of the equilibrium gas.

The adsorption of hydrogen as well as carbon monoxide was higher from mixtures than from the pure gases at equal partial pressures. Evidence was found for the formation of carbon monoxide-hydrogen complexes on the surface, their extent increasing with temperature. These are presumably the precursors and intermediates of methylene groups which later link up to form paraffin chains.

### 312. Preparation of pure potassium bromide from potassium liquor obtained from Felspar.

ESHWAR RAJ SAXENA and D. S. DATAR, Hyderabad Deccan.

The paration of pure potassium bromide using liquor containing potassium sulphate and some potassium hydroxide obtained from Golconda Felspar and iron bromide is described.

Calcium bromide is first prepared by reacting iron bromide with slaked lime. Potassium bromide is then produced by heating calcium bromide with potassium liquor from felspar. It is separated by filtration from calcium sulphate and calcium hydroxide which are also formed.

The product conforms to the B. P. Specification except in so far as it contains 7 % sodium bromide. Potassium bromide is freed from sodium bromide by fractional crystallisation.

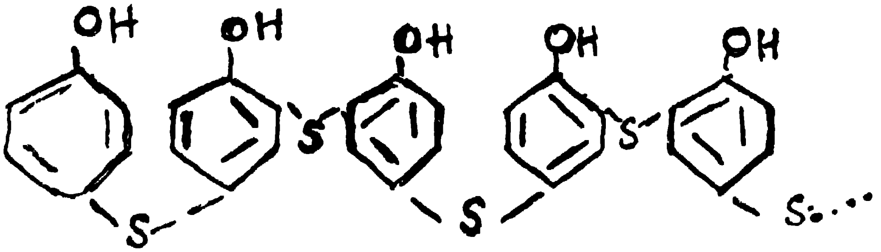
### 313. Active silica from felspar.

In this paper it is shown that active silica may be obtained from felspar by heaeting with calcium carbonate at 800—900°C and then treating with sulphuric acid. It has the same sorptive capacity as that of B. D. H. silica gel. Aluminium and potassium in felspar which go into acid solution may be recovered as potash alum.

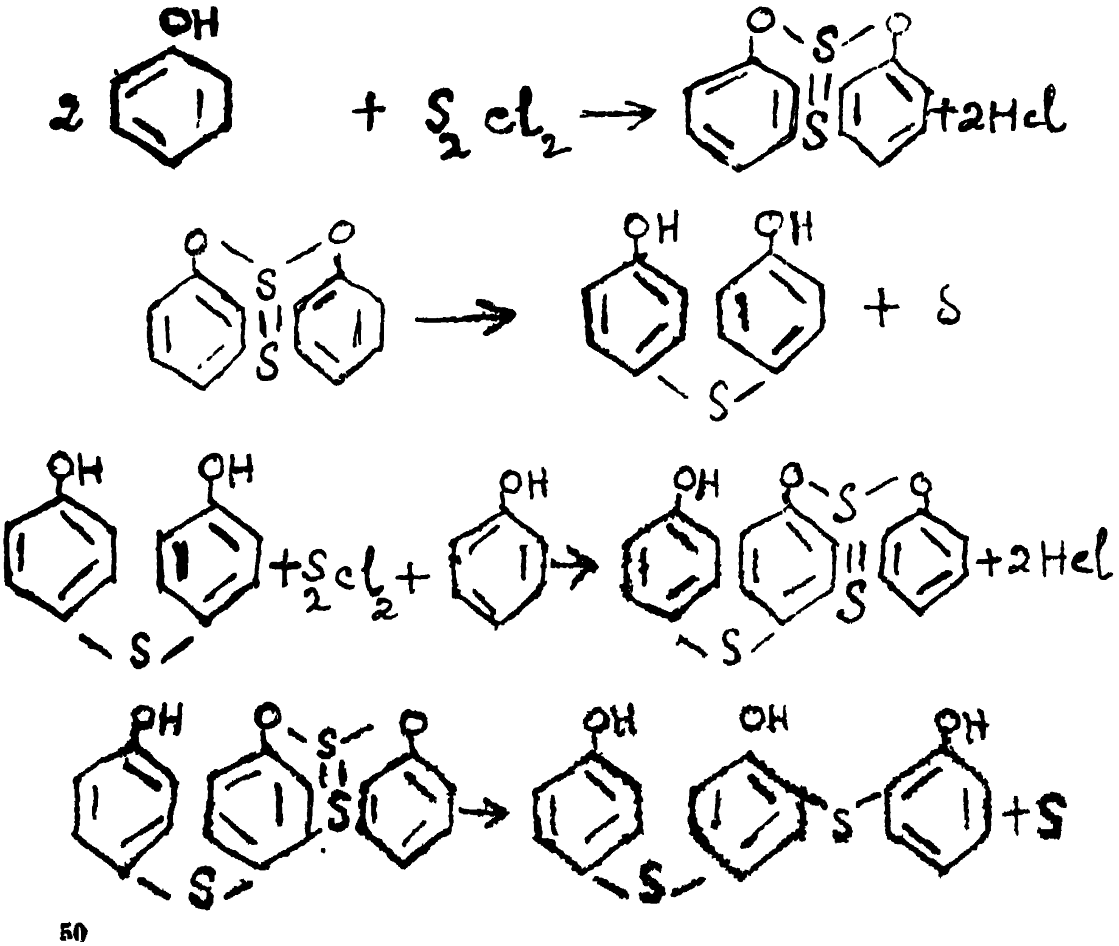
### 314. Sulphur Monochloride-Phenol Resin.

RANJIT SEN GUPTA, Kharagpur.

A "friable fluid" sulphur monochloride-Phenol resin, formed by gradual addition of 10 c c. $S_2Cl_2$ in an emulsion of 10 c c Phenol and a large excess of crushed ice has recently been described by us. (Sen Gupta Science cult. 1951, June). The peculiar rheological properties of the product has led us to study the product in detail. Preliminary work indicates that the resin is a mixture of sulphur and a condensation product of Structure (1)



(S-linking might also be through o—o position alone). This condensation



product is soluble in alkalies and reprecipitated by addition of acid. The formation of this product probably occurs by the following mechanism

etc etc

An analogous reaction mechanism has been found in the reaction of methyl salcylate and thionyl chloride in presence of copper (Hirwe, Jadhav and Chkra deo J A, C S, 1935, *57*, 101),

## 315. Electro-Chemical Treatment of Clays.

K. P SHUKLA, ROORKEE

Electro-Chemical methods to improve the structural properties of clays have been tried by number of investigators like Leo Casagrande, Hoffman and Endell, Winterkorn and others These investigations have been continued on some typical clays of the countries and besides finding out how the current influences the engineering properties of soils the chemical changes brought about by it have also been studied.

Soils free from humus, and free salts and exchangeable bases were prepared by usual methods and cakes from ½ inch to 1 inch thick were treated electrically by passing direct current between Al as anode and Cu as cathode at 60 volts for different periods all time keeping the soil mass saturated The soils thus treated were tested for their engineering properties like Atterberg's Limits Shear Compaction Consolidation and Permeability characteristics and results obtained Compared with those obtained in testing same soils in untreated conditions

It becomes apparent that the electric treatment influences the engineering properties to a marked extent The plasticity index decreases shear strength, permeability, compressibility, compaction density and bearing capacity increases The soil assumes a granular structure Also, the effect of current in impriving the structural properties varies with the type of clay minerals predominating a particular soil The effect is most marked with Beddellite structure and less with Kaolinite while Halloysite occupies the intermediate position

With a view to visualize the effect of current the chemical changes brought about were studied The colloidal portions from each of the soils were separated and treated exactly in the same manner and alaysed for $SiO_2$, $Al_2O_3$, $Fe_2O_3$, exchangeable Aluminium and Free Aluminium both after and before treatment. A study of the results obtained showed clearly that the treatment results in break down of structure $SiO_2/Al_2O_3$ and $SiO_2/R_2O_3$ ratios and bass exchange capacity decreases in every case The current carries away exchangeable ions and replaces them by exchangeable Al which comes from the nucleus of Si-O-Al frame work of lattice Also there is a deposition of Aluminium salt in our case $Al_2(OH)_2$ The duration, and voltage of current applied have significant influenced on those changes.

The chemical changes explain, partly the changes brought in the engineering properties as studied.

### 316. Preparation of Dehydrated Castor Oil to Standard Specifications.

M. A. SIVASAMBAN, S. A. SALETORE and S. H. ZAHEER, Hyderabad,

The urgent need for developing the manufacture of dehydrated castor oil in Indian industry is discussed in the light of the difficulties encountered in preparing products satisfying standard specificatons. As dehydration with sodium bisulphate catalyst alone does not yield products satisfying standard specifications, modifications of the process have been tried out Comparison of the analytical values of the products so obtained with A. S. T. M and India Government specifications indicate the necessity for more work on these lines.

### 317. Utilization of Sambhar Lake Bitterns. II.

C. R. TALPADE and M. A JOSHI, Poona.

Utilisation of Sambhar Lake Bitterns.

It is suggested in this paper that Solvay ammonia process could be safely advocated as one of the methods for the proper utilisation and commercial exploitation of the Sambhar Lake bitterns which contain the chloride, sulphate, carbonate and bicarbonate of sodium.

The sodium utility factor for mixtures of sodium chloride and sulphate is found to be practically of the same order as that in case of sodium chloride brines. The other salts present viz. carbonate and bicarbonate will not vitiate efficiency factor. It is suggested that the economics of putting up a solvay ammonia plant at Sambhar should be seriously considered.

### 318. Studies in Catalytic Oxidation of Ethylene to Ethylene Oxide.

N. VENKATARAMAN, I. B. GULATI and S. K. BHATTACHARYYA, Kharagpur,

The catalytic oxidation of ethylene to ethylene oxide, by air in presence of silver oxide as the catalyst has been investigated. The influence of various factors, e.g., catalyst supports, promoters, and process variables like space velocity, air: ethylene ratio, temperature, etc has been exhaustively studied.

Precipitated silver oxide was used as the basic catalyst and the ethylene used was prepared from ethyl alcohol. The quartz supported catalyst gave a better conversion and selectivity than corondum or pumice supported catalyst. When activated alumina was used as a support the reaction product consisted mainly of carbon dioxide while with kieselguhr it gave very low conversion with an equally low selectivity. With quartz as a support 0 453 gm. silver oxide per c.c. of quartz was found to be the optimum concentration of the catalyst.

Unpromoted silver oxide gave a total conversion of 39.06 % with a selectivity of 61.09 % at 280°C at a space velocity 1500 cc /hr./cc, and air ethylene ratio of 10.5, but there was a gradual fall in activity with use. Barium added as barium peroxide was a better promoter than magnesium or calcium oxides. It gave a total conversion of 48.5 % with a selectivity of 58.3 % at 260°C, space velocity and air ethylene ratio being the same as above. Addition of zinc lowered the activity slightly. Lithium improved the conversion to 52 2 % but the selectivity came down to 48.57 %. Potassium added as potassium carbonate completely poisoned the catalyst immediately, but when added as potassium hydroxide the activity decreased gradually. Copper added by co-precipitation gave a promising catalyst, active at quite low temperatures, while iron and manganese promoted catalysts were very degradative and gave mainly carbon dioxide. Addition of lead and chlorine completely poisoned the catalyst. Catalysts prepared by co-precipitation were more active and in some cases very degradative than those prepared by mechanical mixing.

Molybdenum oxide, vanadium pentoxide, copper oxide, tin vanadate and silver vanadate were found to be extremely degradative leading to almost complete conversion to carbon dioxide.

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